

Master's thesis



Caged contention: The nature and extent of perceived conflict with salmon aquaculture along the Eastern Shore of Nova Scotia

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Declaration

I hereby confirm that I am the sole author of this thesis and it is a product of my own academic research.

Chelsea Boaler

Abstract

Salmon aquaculture is a global industry that has only recently developed to new heights in Canada. Though salmon aquaculture developed sooner in British Columbia, it remains a relatively new marine industry within the Atlantic Provinces. Developing in areas of existing coastal users, the perception is that this expansion has resulted in many conflicts among stakeholders across the country. Most recently in Nova Scotia, there have been a series of applications for new leases for sites along the Eastern Shore that seem to have sparked the newest controversy in the province regarding salmon aquaculture practices. The purpose of this thesis is to gain a better understanding of perceived inter-sectoral conflicts with developing aquaculture on the Eastern Shore of Nova Scotia through a mixed-methods approach including media analyses, community meeting analyses, and interviews. It was found that the province has – and continues to have – regions of conflict along the Eastern Shore related to salmon aquaculture expansion. Recommendations and next-steps towards alleviating conflict and fostering prosperity in rural Nova Scotian coastal communities were made and included multiple points divided into four main areas of needed improvement: Science and Information; Corporate Relations; Governance and Institutionalization; and Finfish Aquaculture Practice.

Útdráttur

Laxeldi er alþjóðlegur iðnaður sem hefur nýlega aukist mikið í Kanada. Þar sem að þetta er tiltölulega nýr sjávariðnaður að reyna að koma sér fyrir og þróast á svæðum þar sem fyrir eru aðrir strandsvæðanotendur, virðist sem þessi stækkun hafi valdið deilum á meðal hagsmunaaðila þvert yfir landið. Nýlegasta dæmið má finna í Nova Scotia þar sem fjöldi nýrra fiskeldisleyfisumsókna hefur komið fram um svæði meðfram austurströndinni sem virðast hafa kveikt nýjustu deilurnar í héraðinu varðandi laxeldismálin. Tilgangur þessarar ritgerðar er að öðlast betri skilning á mögulegum deilum á milli atvinnugreina vegna þróunar fiskeldis á austurströnd Nova Scotia með notkun blandaðra rannsóknaraðferða, þar á meðal fjölmiðlagreiningar, greiningu á samfélagsfundum, og viðtöl við hagsmunaaðila. Niðurstaða rannsóknarinnar var að héraðið hefur – og mun hafa áfram – svæðisbundin átök meðfram austurströndinni sem tengdar eru stækkun laxeldisins. Ráðleggingar og tillögur að næstu skrefum til að leysa þessi ágreiningsmál og til að stuðla að uppbyggingu í sjávarbyggðum Nova Scotia eru settar fram og fela meðal annars í sér fjölmarga punkta sem skipt er upp í fjóra megin þætti sem þarf að bæta: Vísindi og upplýsingar; Fyrirtækjatengsl; Stjórnun og stofnanavæðing, og; Starfsemi fiskeldis.

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Table of Contents

List of Figures	x
List of Tables	xiii
Acronyms.....	xiv
Acknowledgements	xv
1 Introduction.....	17
1.1 Aquaculture	17
1.1.1 Global production, employment, and economics.....	17
1.1.2 Aquaculture in Canada and Nova Scotia	18
1.1.3 Mariculture	20
1.2 Conflict in marine resource uses	20
1.3 Purpose	21
1.4 Brief overview of methodology.....	21
1.4.1 Media analysis	21
1.4.2 Interviews	22
1.4.3 Community meetings.....	22
1.5 Research limitations	23
1.6 Organization	24
2 Theoretical overview.....	25
2.1 Aquaculture structures, intensities, and systems	25
2.2 Aquaculture in Canada and Nova Scotia.....	26
2.3 <i>Salmonidae</i>	27
2.3.1 Salmon species in Canada	28
2.4 Historical context of salmon aquaculture	30
2.4.1 Salmon aquaculture's beginnings in Canada and Nova Scotia	30
2.4.2 Salmon aquaculture operations and specifications.....	31
2.5 Current aquaculture governance in Canada and Nova Scotia	32
2.5.1 Aquaculture legislative framework and responsibilities.....	32
2.5.2 Permits and licenses.....	35
2.5.3 Additional plans and strategies.....	36
2.6 The Eastern Shore of Nova Scotia.....	39
2.6.1 Salmon aquaculture along the Eastern Shore of Nova Scotia: a timeline ...	42
2.7 Aquaculture and social conflict in Atlantic Canada	44
2.8 Research objectives	47

3 Methodology	49
3.1 Media analysis	49
3.1.1 Selection criteria	49
3.1.2 Analytical process of article analysis	50
3.1.3 Spokesperson analysis	51
3.2 Interviews	51
3.2.1 Selection criteria	52
3.2.2 Interview process	52
3.2.3 Interview analysis	53
3.3 Community meeting analysis	54
4 Results	57
4.1 Media analysis	57
4.1.1 Article analysis	57
4.1.2 Topic analysis	58
4.1.3 Spokesperson analysis	59
4.2 Community meeting review	60
4.2.1 Eastern Shore community meetings	61
4.3 Interviews	62
4.3.1 Personal associations with salmon aquaculture	63
4.3.2 Perceived conflict by sector	63
4.3.3 Nature of perceived conflict	64
4.3.4 Spatial perception of conflict	69
4.3.5 Alleviation of perceived conflict	70
5 Discussion and conclusions	71
5.1 General comparisons: media analysis, community meetings, and interviews	71
5.2 Socio-economic context of result	72
5.2.1 Demographics and economic influences	72
5.2.2 Social constraints	75
5.3 Recommendations for the Eastern Shore and further research opportunities	75
5.3.1 Regulatory reform	75
5.3.2 Risk analysis	76
5.4 Research limitations and suggestions	79
References	80

List of Figures

Figure I: Aquaculture production (metric tonnes and value) in Canada from 1990 to 2010 (DFO, 2013b)	18
Figure II: Nova Scotia, Canada. The provincial capital, Halifax, is highlighted (The Halifax Explosion, 2007)	20
Figure III: 2008 Canadian aquaculture output in metric tonnes by species and by province (CCFAM, 2010)	27
Figure IV: Salmon Fishing Areas (SFAs) of Nova Scotia (DFO, 2012)	29
Figure V: Number of aquaculture licences in Canada by province and species (DFO 2013g).	35
Figure VI: Aquaculture zones in Eastern Canada (Atlantic) (Parliament of Canada, 2010)	39
Figure VII: The Eastern Shore of Nova Scotia (Government of Nova Scotia, 2014a)	41
Figure VIII: The electoral districts of Nova Scotia For the purpose of this thesis, the Eastern Shore region is represented by electoral districts 20 (Guysborough-Eastern Shore Tracadie district) and 21: (Eastern Shore district) (Government of Nova Scotia, 2014b)	42
Figure IX: Story types of aquaculture-related pieces within a media analysis conducted on Canadian pieces from August 1, 2012 to July 31, 2013	58
Figure X: Themes within aquaculture-related pieces within a media analysis conducted on Canadian pieces from August 1, 2012 to July 31, 2013	59
Figure XI: Pieces with quotes, individuals quoted, and total quotes within aquaculture-related pieces within a media analysis conducted on Canadian pieces from August 1, 2012 to July 31, 2013	60
Figure XII: Communities in which the Panel's community meetings regarding aquaculture regulatory reform took place from July to September 2013 with attendee numbers in brackets. The communities representing the Eastern Shore are circled in red (modified from Doelle-Lahey Panel, 2013)	61

Figure XIII: Identified conflict terms (nodes) regarding existing and/or potentially expanding salmon aquaculture along the Eastern Shore of Nova Scotia as described by interviewees	66
Figure XIV: Perceived geographic areas of conflict with existing and/or potentially expanding salmon aquaculture along the Eastern Shore of Nova Scotia as described by interviewees (in red). The communities represented through interviews are identified.....	69
Figure XV: Suggestions for conflict alleviation and steps-forward in regards to salmon aquaculture as indicated by interviewees along the Eastern Shore of Nova Scotia.....	70
Figure XVI: Number of Nova Scotians migrating from the province, by province of destination, from 2000 to 2013 (Employment and Social Development Canada, 2013)	73
Figure XVII: Net migration of Nova Scotians by age from 2000 to 2001 (Employment and Social Development Canada, 2013)	73
Figure XVIII: Project social risk model, as may be used for social risk analysis for salmon aquaculture sites (adapted from FAO, 2008)	77

List of Tables

Table I: Types of aquaculture and production (metric tonnes) in Canada, by province (DFO, 2011a; DFO, 2013c)	19
Table II: 2012 Canadian aquaculture production (CAD\$000) by province. Salmon and mussel value highlighted (adapted from DFO, 2013d)	27
Table III: Federal departments and agencies with significant responsibility for aquaculture (House of Commons, 2003)	34
Table IV: Identified issues within the Panel's community meetings along the Eastern Shore of Nova Scotia regarding aquaculture regulatory reform took place from July to September 2013	62
Table V: Sectoral affiliations of interviewees from the Eastern Shore of Nova Scotia	63
Table VI: Perceived conflict among stakeholders and existing and/or potentially expanding salmon aquaculture along the Eastern Shore of Nova Scotia as described by interviewees. Numbers indicate the frequency of interviewees who indicated the perceived conflict among stakeholders. The colours indicate directional conflict, where blue indicates the aquaculture industry exerting conflict with the listed stakeholder, and green indicating the listed stakeholder exerting conflict with the aquaculture industry. Total numbers indicate instances of perceived conflict between the salmon aquaculture industry and identified stakeholders	64
Table VII: Categorized emerged themes of the nature of perceived conflict as per interviewees. Numbers indicate the frequency of interviewees who mentioned theme (node)	65
Table VIII: Risk evaluation matrix for determining level of risk (Standards Australia, 2004a in FAO, 2008)	79

Acronyms

ABC	Audit Bureau of Circulation
ACFAM	Atlantic Council of Fisheries and Aquaculture Ministers
ADD	Acoustic Deterrent Device
APES	Association for the Preservation of the Eastern Shore
CBA	Cost Benefit Analysis
CCAB	Canadian Circulation Audits Board
CCFAM	Canadian Council of Fisheries and Aquaculture Ministers
CMCA	Canadian Media Circulation Audit
DHON	Dressed Head On
DO	Dissolved Oxygen
EIA	Environmental Impact Assessment
ENGO	Environmental Non-Governmental Organization
ESSIM	Eastern Scotian Shelf Integrated Management Plan
FAO	Food and Agriculture Organization of the United Nations
HADD	Harmful Alteration, Disruption or Destruction
MOU	Memorandum of Understanding
NASAPI	National Aquaculture Strategic Action Plan Initiative
NGO	Non-Governmental Organization
NSAS	Nova Scotia Aquaculture Strategy
NSCS	Nova Scotia Coastal Strategy
RPA	Recovery Potential Assessment
SFA	Salmon Fishing Area
UNESCO	United Nations Educational Scientific and Cultural Organization
WWF	World Wildlife Fund

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1 Introduction

1.1 Aquaculture

Aquaculture differs from wild fisheries such that aquatic animals are raised rather than hunted. The Food and Agriculture Organization of the United Nations (FAO) defines aquaculture as follows:

The definition of aquaculture is understood to mean the farming of aquatic organisms, including fish, mollusks, crustaceans and aquatic plants. Farming implies some kind of *intervention* in the rearing process to enhance production, such as regular stock, feeding, protection from predators, etc. Farming also implies individual or corporate *ownership* of stock being cultivated.

(FAO, 2014, para. 2, emphasis in original)

In the Canadian context, aquaculture is defined as the “farming of fish, shellfish and aquatic plants in fresh or salt water” (DFO, 2013a, para. 4). Though agriculture originated 10,000 years ago as hunting-and-gathering became less common, aquaculture is more recent to human history, developing a few hundred years BC in China (Lucas & Southgate, 2003). This period was known as the “Golden Age”, where from 500 BC to 500 AD, the cultivation of the common carp flourished (FAO, 1988). Aquaculture output has since grown globally, providing 43 percent of consumed aquatic protein in 2007 (Bostock *et al.*, 2010).

1.1.1 Global production, employment, and economics

In 2010, the global aquaculture industry produced 78,879,653 tonnes of aquatic organisms in both inland and marine waters valued over USD\$1.2 billion (FAO, 2010). As of 2010, there were 27 primary countries that produced over 130,000 tonnes of aquaculture products: China, India, and Viet Nam are the top three producers, and freshwater fishes are

the most popularly raised aquatic animals globally. Based on the most complete data from 2005, the FAO estimates aquaculture accounts for 23.4 million full-time, 16.7 million direct, and 6.8 million indirect jobs, as a global sector (Valderrama, Hishamunda & Zhou, 2010).

1.1.2 Aquaculture in Canada and Nova Scotia

Canada participates in finfish, shellfish, and plant aquaculture. Overall production across the country has increased relatively steadily from 1990 to 2002, with fluctuations between 2003 and 2010. (Figure I: DFO, 2013b). Specific species of cultured organisms vary depending on the province (Table I: DFO, 2011a).

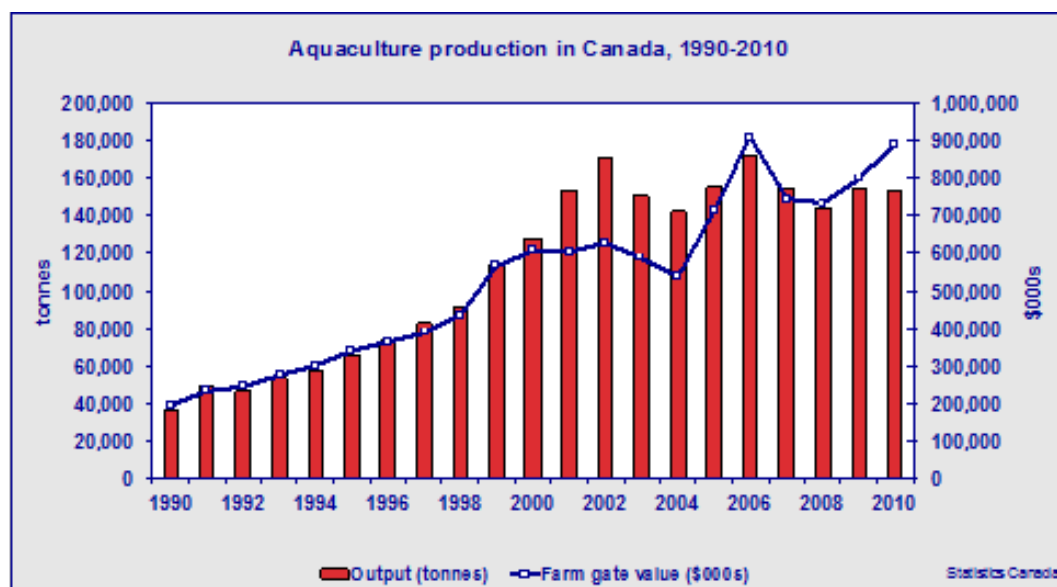


Figure I: Aquaculture production (metric tonnes and value) in Canada from 1990-2010 (DFO, 2013b).

Nova Scotia is a Maritime province located on the eastern coast of Canada (Figure II: The Halifax Explosion, 2007). It is the second smallest Canadian province in size at 52,939 squared kilometers with a population of 921,727 as of 2011 (Statistics Canada, 2014). The provincial capital and main economic centre of the province is Halifax. That being said, the rural areas of the province depend on multiple sectors including fisheries and aquaculture, forestry, mining, oil and gas, agriculture, and tourism (RCIP, 2003). Nova Scotia participates in Atlantic salmon, Arctic char, halibut, steelhead trout, tilapia, Eastern oyster,

blue mussel, and seaweed aquaculture (Table I: DFO, 2011a), contributing 4.7 percent to the total national tonnage in aquaculture production (DFO, 2013c).

Table I: Types of aquaculture and production (metric tonnes) in Canada, by province (DFO, 2011a; DFO, 2013c).

Province/Territory	Finfish	Shellfish	Plant	Production
Newfoundland and Labrador	Atlantic Salmon, Steelhead Trout, Cod	Mussels	-	21,228
Nova Scotia	Atlantic Salmon, Arctic Char, Halibut, Steelhead Trout, Rainbow Trout, Tilapia	Eastern Oysters, Blue Mussels, Clams, Quahogs, Abalone	-	8,238
Prince Edward Island	Rainbow Trout, Arctic Char	Blue Mussels, Eastern Oysters	-	24,637
New Brunswick	Atlantic Salmon, Rainbow Trout, Steelhead Trout, Cod, Halibut	Eastern Oysters, Blue Mussels	Seaweed	31,481
Quebec	Arctic Char, Rainbow Trout, Brook Trout, Speckled Trout	Eastern Oysters, Blue Mussels, Sea Scallops	-	739
Ontario	Rainbow Trout, Arctic Char, Tilapia, Sturgeon	-	-	3,700
Manitoba	Rainbow Trout, Arctic Char	-	-	No data available
Saskatchewan	Rainbow Trout, Steelhead Trout	-	-	
Alberta	Rainbow Trout, Tilapia	-	-	
British Columbia	Atlantic Salmon, Chinook Salmon, Coho Salmon, Sturgeon, Rainbow Trout, Tilapia, Sablefish	Pacific Oysters, Manila Clams, Varnish/Savory Clams, Blue Mussels, Mediterranean Mussels, Japanese Scallops	Seaweed	81,395
Yukon	Arctic Char	-	-	No data available
Northwest Territories	Arctic Char	-	-	
TOTAL				173,252

*Provinces for "no data available" are included in total.



Figure II: Nova Scotia, Canada. The provincial capital, Halifax, is highlighted (The Halifax Explosion, 2007).

1.1.3 Mariculture

Mariculture is simply aquaculture in marine waters. A 2013 study conducted by the FAO found that from 2004 to 2008, there were 93 of 165, or 56 percent, of countries and territories participating in mariculture, producing a total of almost 30 million tonnes annually over the four years. The intensity of this mariculture ranges on a global scale from one to 519, with an average of five, tonnes per kilometre of coastline. That being said, 50 percent of the 93 countries and territories practicing mariculture do so with low intensity at less than one tonne per kilometre of coastline. Practically all mariculture is considered inshore (sheltered bays and inlets).

1.2 Conflict in marine resource uses

The oceans are no strangers to conflict; from oil and gas, to fisheries, to military testing, to mining, there is a history of conflict both intra- and internationally, such that technological advancements are continuously transforming man's relationship with the seas (United

Nations, 1998). Development of aquaculture as a “new” industry has potential to add another dimension to coastal and marine management, as has been exemplified through the work and existing studies of various organized groups (APES, n.d.; Government of Newfoundland, n.d.; EAC, n.d.; Walters, 2007; WWF, 2014). Such conflict is brought on mainly by the fact that suitable aquaculture sites – including proximity to existing infrastructure – are often those where existing industries have already been established (House of Commons Canada, 2003).

1.3 Purpose

Aquaculture is an existing and prosperous coastal industry globally, and within Canada, though Nova Scotia contributes minimally to the national total, both in tonnage and in value. The purpose of this thesis is to gain a better understanding of perceived inter-sectoral conflicts with the developing salmon aquaculture sites on the Eastern Shore of Nova Scotia through media analyses, community meeting analyses, and interviews. Through such, recommendations and next-steps towards alleviating conflict and fostering prosperity in rural Nova Scotian coastal communities can be made.

1.4 Brief overview of methodology

This study was conducted using a mixed-methods approach (Bazeley, 2008; Creswell, 2009). A mixed methods approach incorporates multiple data sources and analysis tools. A quantitative media analysis was conducted and compared to results of semi-structured interviews and community meeting analyses. A mix of manual and electronic analysis methods were used as described below, and in further detail within Section 3: Methodology.

1.4.1 Media analysis

A formal media analysis was undertaken regarding Canadian finfish aquaculture, exploring how the topic has been discussed within the Canadian media with a one year time-span from August 1, 2012 to July 31, 2013. The analysis consisted of an article and spokesperson analysis of 80 pieces from the top daily and national newspapers in the country, as well as top broadcast stations (Radio/TV), and online Canadian news sources.

1.4.2 Interviews

A total of 14-23 stakeholders were to be interviewed using a semi-structured interview process (Creswell, 2009) to determine the nature and extent of perceived conflicts related to salmon aquaculture development along the Eastern Shore of Nova Scotia. Interview participants were to span the following sectors along the Eastern Shore of Nova Scotia: (1) Aquaculture (3 interviewees); (2) Inshore fisheries (2-4); (3) Offshore fisheries (1-2); (4) Ocean-based tourism (2-3); (5) Inland tourism (1-2); (6) Landowners/Residents (2-4); (7) Recreationists (1-2); (8) Local Environmental Non-Governmental Organizations (ENGOS) (1-2); and (9) Planners and policy makers (1-2).

The number of those interviewed is based on the length of the study and the intended spatial and sectoral coverage of interviewees, as described in the Economic and Social Research Council methodological review (Baker, 2012). The intended themes to be covered included the nature and extent of conflict surrounding salmon aquaculture development on the Eastern Shore of Nova Scotia as perceived by those who associate with Eastern Shore communities. The semi-structured interviews were recorded, and the audio was manually coded using computer software, Nvivo10, in order to pull out the main themes regarding salmon aquaculture along the Eastern Shore of Nova Scotia. ArcGIS was used to map areas of existing or potential conflict, as identified by the interviewees, providing the opportunity to mark in which communities coastal conflict with the salmon aquaculture sector were perceived.

1.4.3 Community meetings

The Doelle-Lahey Panel is currently conducting the Independent Aquaculture Regulatory Review for Nova Scotia. From July to September 2013, the Panel conducted community meetings across Nova Scotia where residents were encouraged to share their concerns related to the aquaculture industry as a whole and recommendations contributing to regulation reform across all forms of aquaculture in the province. The transcripts from these meetings were analyzed, also using the Nvivo10. These transcripts were then compared to the interview data, allowing for not only opportunities to compare similarities, but also to identify any gaps between data sets.

1.5 Research limitations

The research limitations of this study include time, spatial coverage of interviews, and methodologies of interviews, including researcher experience. The time in which interviewees were allowed to be approached was significantly reduced as the Dalhousie Ethics Review Panel reviewed the study and methodologies, granting permission in late October, 2013 after the initial submission in July, 2013. Initial contacts with potential interviewees then took place in November and December 2013, and interviews were completed in early February, 2014. The majority of the interviewees included those who associated with the southern part of the Eastern Shore. Two of the interviews took place over the phone, as dangerous winter weather events were frequent, not allowing for face-to-face interviews. Although the same information was collected, this change in methodology provided inconsistency across interviews. Additionally, the experience level of the primary researcher in qualitative research was near inexistent. This inexperience, however, was counteracted by involving a supervisor with in-depth knowledge of methodologies and analyses in qualitative works.

1.6 Organization

The theoretical overview of this thesis encompasses an outline of aquaculture types and technology. A brief history of aquaculture globally and in Nova Scotia is reviewed, with a focus on salmon aquaculture in particular. This overview includes motivations for the development of salmon aquaculture, and the results in terms of province-specific production, employment, and industry value. Canadian and Nova Scotian aquaculture regulatory frameworks and policies are summarized. A history of conflict in marine resources, particularly in aquaculture within Atlantic Canada, is described. The Eastern Shore, as the case study site, is overviewed in order to contextualize the data. The theoretical overview is followed by a detailed methodology and results. The discussion draws conclusions from the results, allowing for recommendations and steps-forward to be made, as well as any missing or shallow information to be highlighted through areas of future research.

2 Theoretical overview

2.1 Aquaculture structures, intensities, and systems

There are currently diverse forms of aquaculture that, in turn, involve diverse operational structures. Ponds are defined as “earthen impoundments for holding aquatic species” (Lucas & Southgate, 2003, p. 12). Such structures are used primarily with fresh- or brackish-water systems and vary in form: Sunken pond, consisting of an in-ground hole; Barrage pond, where one or more walls exist; or Embankment pond, where the pond is above ground (Lucas & Southgate, 2003). Ponds are the most widely used structures for aquaculture globally. Tanks and raceways are the next most popular structures. They are solid structures, can be either indoors or outdoors, and vary in their shape and dimension. Cages are open to the surrounding environment. They can be square, rectangular, or circular and can be found in ponds, lakes, estuaries, bays, or in open seas. They consist of collars which help maintain shape, floats, netting, and moorings that attach a cage to its site. These structures are often also referred to as “net-pens”. Pens, on the other hand, are enclosures found in shallow waters and confine the cultured species to a particular area. Lastly, there are benthic, racked, and suspended cultures. These structures are used for benthic and attached species, such as bivalves *e.g.* clams and mussels.

Aquaculture can be divided into three main levels of intensity: (1) Intensive; (2) Extensive; and (3) Semi-intensive (Lucas & Southgate, 2003). Intensive systems require multiple levels of intervention:

No recycling of energy and totally non-self-supporting the requirement for high inputs of energy (*e.g.* feed, nutrients, aeration, filtration, pumping) high yields per unit area or volume.

(Lucas & Southgate, 2003, p. 21)

Extensive systems require little to no input in order to grow and harvest a successful stock *e.g.* benthic, racked, suspended, and pond cultures (Lucas & Southgate, 2003). Though

there is no concrete line between intensive and extensive systems, semi-intensive is used to describe those systems that fall between the two extremes.

There are four main types of aquaculture systems: (1) Static systems, which have no water exchanges; (2) Open systems, which rely on natural water circulations, as in a lake or an ocean; (3) Semi-closed systems, which exchanges water with the surrounding environment without the culture being directly in a natural body of water *e.g.* pumping water in, and releasing waste water from, an inland tank system; and (4) Recirculation or closed systems, which involve recirculation and treatment of water, where less than five percent of water is replaced per day (Lucas & Southgate, 2003).

2.2 Aquaculture in Canada and Nova Scotia

Aquaculture is an expanding industry that has been present in Nova Scotia, for more than 30 years (Government of Nova Scotia, 2012). From 1986 to 1988, the value of Canadian aquaculture production jumped in value from CAD\$35 million to CAD\$433 million. By 1999, the Canadian aquaculture industry was valued at CAD\$558 million (DFO, 2013a). Currently, the Nova Scotian aquaculture sector contributes over CAD\$52 million annually to the CAD\$833 million national worth of the aquaculture sector (DFO, 2013d; Government of Nova Scotia, 2012; Parliament of Canada, 2010) while providing over 750 direct, and 1,000 indirect, jobs in the province (Government of Nova Scotia, 2012). Atlantic salmon (*Salmo salar*) has been farmed in Canada since the 1970s and is now the most popular farmed species in the country (Figure III: CCFAM, 2010; DFO, 2006). Although the overall tonnage of aquaculture production in Nova Scotia is less than that of Prince Edward Island, the species of choice (salmon and blue mussels) makes for a higher return (Figure III: CCFAM, 2010; Table II: DFO, 2013d).

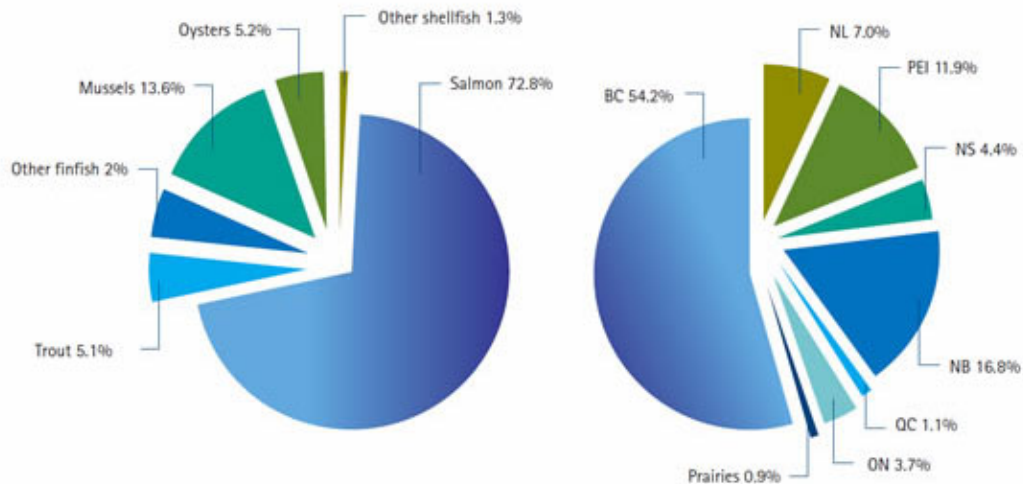


Figure 111: 2008 Canadian aquaculture output in metric tonnes by species and by province (CCFAM, 2010).

Table II: 2012 Canadian aquaculture production (CAD\$000) by province. Salmon and mussel value highlighted (adapted from DFO, 2013d).

	NFLD	PEI	NS	NB	QUE	ON	MB SK AB	BC
Salmon	0	0	40,124	184,966	0	0	0	373,755
Total Finfish	99,286	3,656	41,905	186,386	2,367	18,300	x	742,231
Mussels	13,518	27,918	1,876	9	333	0	0	855
Total Shellfish	13,518	34,838	10,329	5,229	489	0	0	18,823

x = data not available

2.3 *Salmonidae*

The fish family *Salmonidae* consists of over 10 genera and 220 species of salmon, trout, char, grayling, and whitefish species (Anderson, 2007; Nelson, 1976; University of Michigan, 2012). Salmonids are found in the northern hemisphere, and most are anadromous: returning to fresh water to spawn after spending a varying fraction of their adult life at sea (Anderson, 2007; Nelson, 1976). The genera *Oncorhynchus* and *Salmo*, found in the Pacific and Atlantic respectively, arose five-24 million years ago (Anderson, 2007).

2.3.1 Salmon species in Canada

On the west coast of Canada, there are five species (genus *Oncorhynchus*) of salmon that occur naturally: Chinook (*O. tshawytscha*); Chum (*O. keta*); Coho (*O. kisutch*); Pink (*O. gorbuscha*); and Sockeye (*O. nerka*) salmon (Anderson, 2007; DFO, 2013c). Two fish under the *Oncorhynchus* genus, known as steelhead and rainbow trout, are also found in the Pacific. They have both more recently been classified as the same species, *O. mykiss* (WWF, n.d.). The Atlantic salmon (*S. salar*) is the only salmon naturally occurring on the east coast of Canada. Atlantic salmon are anadromous and undergo six life-cycle stages as they move throughout various aquatic habitats: egg (fresh water); alevin; fry; smolt (enters brackish water); ocean-phase salmon (sea water); and spawner (migration back to home river) (DFO, n.d.).

2.3.1.1 Atlantic salmon in Canada

Though the first evidence of human awareness of salmon was 10,000 to 50,000 years ago, identified through paintings in French and Spanish caves (WWF, n.d.), the first mention of Atlantic salmon in North America was around 1000 AD by Norse explorer Leif Eriksson (DFO, 2008). Naturally, *S. salar* was found in approximately 870 rivers from the Hudson River in New York up to the St Lawrence River. The current range in Canada extends from the mouth of the Bay of Fundy to the Fraser River, Labrador (DFO, 2008), though its range in North America does extend as far south as Connecticut, United States (Anderson, 2007). There are, as of July 2008, 728 salmon rivers in Canada where *S. salar* have, or had, been present within the last 50 years. North American wild *S. salar* stocks have significantly declined in recent decades, whereby numbers fluctuated between 0.8 and 1.7 million fish of one sea-winter age from 1971 to 1985 (DFO, 2009a). From 1995 to 2004, numbers ranged from 0.4 to 0.7 million fish. Since 1984, there has been no commercial fishing of *S. salar* in Canada's Maritime Provinces, separate from recreational and Aboriginal fishing, which still takes place. The World Wildlife Fund (WWF) (2001) reports a 75 percent decline in wild Canadian Atlantic salmon populations from 1970 to 2000.

2.3.1.2 Salmon rivers in Nova Scotia, Canada

Salmon rivers in Nova Scotia are often referenced by the fishing zone in which they are found, referred to as Salmon Fishing Areas (SFAs). There are five main fishing areas in Nova Scotia (Figure IV: DFO, 2012): SFA 18, Gulf Shore Nova Scotia; SFA 19, Cape Breton East; SFA 20, Eastern Shore; SFA 21, Southwestern Nova Scotia; and SFA 22, Upper Bay of Fundy (DFO, 2012). SFA 20, Eastern Shore, was closed to recreational fishing in 2010 (DFO, 2011b). SFAs 20 and 21 contain within them 72 rivers where *S. salar* have been historically found (DFO, 2013e). Acidification is the main culprit of the salmon declines in these rivers: salmon were found in only 21 of 54 rivers surveyed from 2008 to 2009. Within SFA 20, the main river is the St. Mary's River. A 2012 study illustrates an increase from both 2011 and the past five-year average of salmon numbers, although these abundances are not statistically significant (see DFO, 2013e, p. 10).

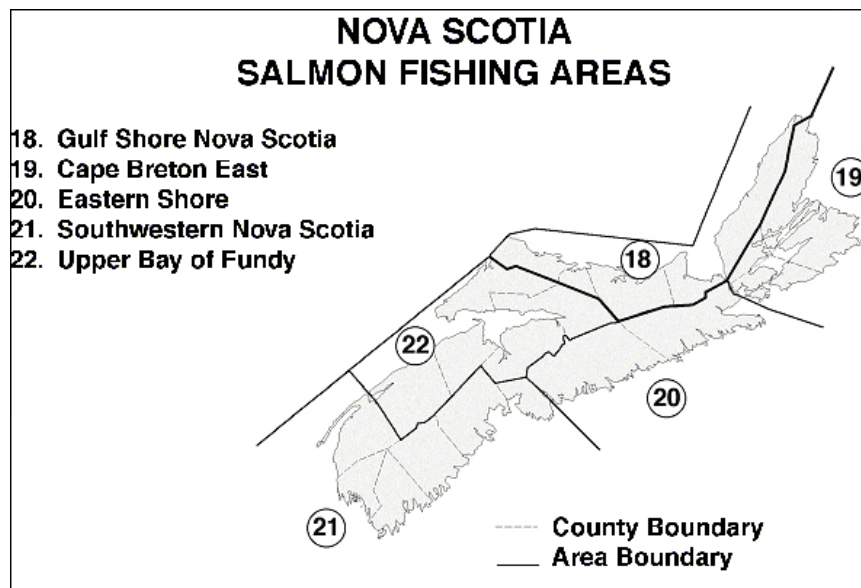


Figure IV: Salmon Fishing Areas (SFAs) of Nova Scotia (DFO, 2012).

2.4 Historical context of salmon aquaculture

2.4.1 Salmon aquaculture's beginnings in Canada and Nova Scotia

Anecdotally, it is believed that First Nations practised aquaculture by moving fish among ponds and streams, though the first record of planned efforts was not until 1857 (House of Commons Canada, 2003). The very first salmon hatchery was established as part of a river restocking effort in 1857 in Quebec City (Anderson, 2007; DFO, 2013f; Parliament of Canada, 2010). Additional hatcheries, then known as an ovariums, developed across Quebec and the Maritimes in order to restock near-by rivers with fry and one- or two-year parr in order to replenish both commercial and recreational fish stocks (Anderson, 2007). By the 1950s, 750 million salmon and trout were being produced on a yearly basis for governmental restocking efforts to enhance recreational fishing (DFO, 2013f). Farming salmon in marine conditions in Canada – rather than just hatchery operations – became possible in the 1970s. This development was due largely to the discovery of similar conditions as were found suitable for salmon farming in the fjords of Norway. Salmon farming was first established along the Sunshine Coast, British Columbia, and in the Bay of Fundy, New Brunswick on the eastern shore of Canada. Commercial salmon farming then became prominent in the 1980s, and developed quickly along both the western and eastern coasts of the country (DFO, 2013f; Parliament of Canada, 2010). The hasty development of the salmon aquaculture industry lead to policy frameworks and review reports, mainly triggered by escapees of farmed salmon into wild habitats in British Columbia.

There were 13 salmon farms in operation in Nova Scotia as of 1987, producing 37 metric tonnes of fish (Bailey, Jentoft & Sinclair, 1996). In the mid-1990s, however, the Nova Scotia industry consisted mostly of mussels and trout, with some salmon and oyster aquaculture. *S. salar* is now the most commonly farmed species in the province. Current farming operations in the province are found mostly within the Bras d'Or Lakes, the Annapolis Basin, Shelburne Harbour, and St. Margret's Bay (Parliament of Canada, 2010).

2.4.2 Salmon aquaculture operations and specifications

2.4.2.1 Production cycle

There are three main phases in the production cycle for finfish, including salmon: (1) Hatchery; (2) Grow-out; and (3) Processing (DFO, 2009b). The hatchery phase mimics river-dwelling, and thus consists of egg fertilization and incubation in fresh water. Here, the salmon develop through egg, fry, parr, and smolt stages. This phase normally lasts 18 months. Once the salmon have gone through the smoltification process – weighing in at 75 to 100 grams – they are moved to seawater, most commonly in sea cages. During this grow-out phase, the salmon are raised to market size – four to five kilograms – over a period of 16 to 24 months. The salmon are then harvested and moved into the third phase of their production cycle, which is processing. Salmon in British Columbia are mainly Dressed Head On (DHON), where the fish are simply cleaned and gutted. Steaks and fillets are more commonly processed along the eastern shores of the country. The Department of Fisheries and Oceans Canada (DFO) (2009b) claims these differences in processing are due to market demands.

2.4.2.2 Site-specific characteristics for caged salmon grow-out

There are various salmon farming techniques, though the most common practice globally, including Canada, is the use of net-pens, a culture environment enclosed in netting on all sides save for the surface (BurrIDGE *et al.*, 2010). Such a system allows the free exchange of water between the environment within the pen and the surrounding environment as an open system. Sheltered coastal waters – including bays, fjords, and lochs – are ideal for cage aquaculture (Lucas & Southgate, 2003). Though nursery grounds utilize fresh water for salmon development, net-pens are typically situated in coastal areas where salinity sits between 32 and 35 parts per thousand. These coastal waters must be examined in greater detail. Factors such as current speed, water exchange and depth, and tidal range must be considered prior to cage implementation. As suggested by Lucas and Southgate, 2003 (p. 310) the desirable net-pen site characteristics include:

- adequate depth (minimum 5 m beneath the net)
- minimum average current flow of about 3 cm/s
- a high oxygen concentration (> 80% saturation)
- relatively clear water to observe fish
- a good water exchange to flush nutrients from the area and supply dissolved oxygen (DO)
- a sandy substrate
- sufficient distance from predator colonies (*e.g.* seals)

Generally speaking, those operating open systems such as salmon net-pens have much less control, if any, over the environment in which the fish habituate (Lucas & Southgate, 2003). Variation in seawater conditions and, in particular, temperature across the seasons may lead to variation in growth and survival rates among harvesting periods.

2.5 Current aquaculture governance in Canada and Nova Scotia

2.5.1 Aquaculture legislative framework and responsibilities

The responsibilities regarding the legislation of aquaculture in Canada, including that for salmon and other finfish aquaculture, are divided among numerous agencies (Table III: House of Commons, 2003; Parliament of Canada, 2010).

There are two main Memorandums of Understanding (MOUs) in terms of fisheries and aquaculture in Nova Scotia: one hierarchical, and one regional. The MOU between the federal and provincial governments allows the provincial Minister of Fisheries and Aquaculture to control the approval and issuance of licenses and leases (Government of Nova Scotia, 2012). The province is also responsible for ensuring federal regulations are being actively followed, including inspection under the *Fisheries Act* as described by VanderZwaag & Chao (2006, p. 57):

Nova Scotia will conduct periodic inspections of aquaculture facilities [...] and will advise the appropriate federal authority of any breach of applicable federal legislative or regulatory requirements.

The Agreement on Inter-Jurisdictional Cooperation with Respect to Fisheries and Aquaculture between the federal government and regional governments of New Brunswick, Nova Scotia, Quebec, Prince Edward Island, Newfoundland and Labrador, and Nunavut was signed September 1999. The Agreement gave rise to committees including the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM), a Deputy Ministers Committee, an Inter-jurisdictional Working Group of Senior Officials, and a Strategic Management Committee on Aquaculture (Government of Nova Scotia, 2012).

Regionally, an MOU is shared among the four Atlantic Provinces, through which “sustainable” industry is supported in the region. The Atlantic Council of Fisheries and Aquaculture Ministers (ACFAM) “provide[s] a forum to exchange information on and to facilitate coordination of approaches to Atlantic fisheries issues (including aquaculture)” (Government of Nova Scotia, 2012, p. 7).

Table III: Federal departments and agencies with significant responsibility for aquaculture (House of Commons, 2003).

Agency	Statute/Regulation	Responsibility
Fisheries and Oceans Canada (DFO)	<i>Fisheries Act</i>	Prevention of the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat Prohibition on the deposition of deleterious substances (delegated to Environment Canada)
	<i>Marine Mammal Regulations and Fishery (General) Regulations (Fisheries Act)</i>	Authorizations to kill predators and operate Acoustic Deterrent Devices (ADDs)
	<i>Fish Health Protection Regulations (Fisheries Act)</i>	Regulation of the importation of fish eggs into Canada and transfer across provincial boundaries
Canadian Coast Guard (DFO)	<i>Navigable Waters Protection Act</i>	Approval of salmon farm plans if the farm is located in navigable waters or if improvements to a farm could impede navigation
Canadian Food Inspection Agency (Agriculture and Agri-Food Canada)	<i>Fish Inspection Act</i>	Product and process standards contributing to acceptable quality, safety and identity of fish and seafood products, and assurance of compliance with standards
	<i>Health of Animals Act</i>	Importation of veterinary biologics
	<i>Feeds Act</i>	Assurance of safety, effectiveness and correct labeling of livestock feeds, including medicated feeds
Veterinary Drugs Directorate (Health Canada)	<i>Food and Drugs Act</i>	Safety of foods for human consumption from animal sources, including fish treated with veterinary drugs Safety and effectiveness for animals of veterinary drugs sold in Canada
Pest Management Regulatory Agency (Health Canada)	<i>Pest Control Products Act</i>	Registration of pest control products in Canada
Canadian Environmental Assessment Agency	<i>Canadian Environmental Assessment Act</i>	Require an environmental assessment where triggered by the <i>Navigable Waters Act</i> (section 5) or the <i>Fisheries Act</i> (section 35)

2.5.2 Permits and licenses

Anyone who wishes to set up an aquaculture site must apply for a licence through the province (Government of Nova Scotia, 2013). If approved by the Minister of Fisheries and Aquaculture, the applicant is granted a licence to conduct the activity, however, waiting times can take up to three and a half years when an Environmental Impact Assessment (EIA) is needed. An EIA is needed for any sea-based aquaculture. The majority of issued licenses across Canada are for marine shellfish, which also stands true for Nova Scotia (Figure V: DFO, 2013g). A lease is needed when the commercial aquaculture activity takes place on public lands (including water bodies). If approved by the Minister, the applicant is able to conduct the activity on Crown Land. The lease grants “exclusive property rights to the location designated for the aquaculture activity that is to be carried out” (Government of Nova Scotia, 2013, para. 2). Initial leases and licences are valid for 10 years and need to be renewed every five years after the initial issuance.

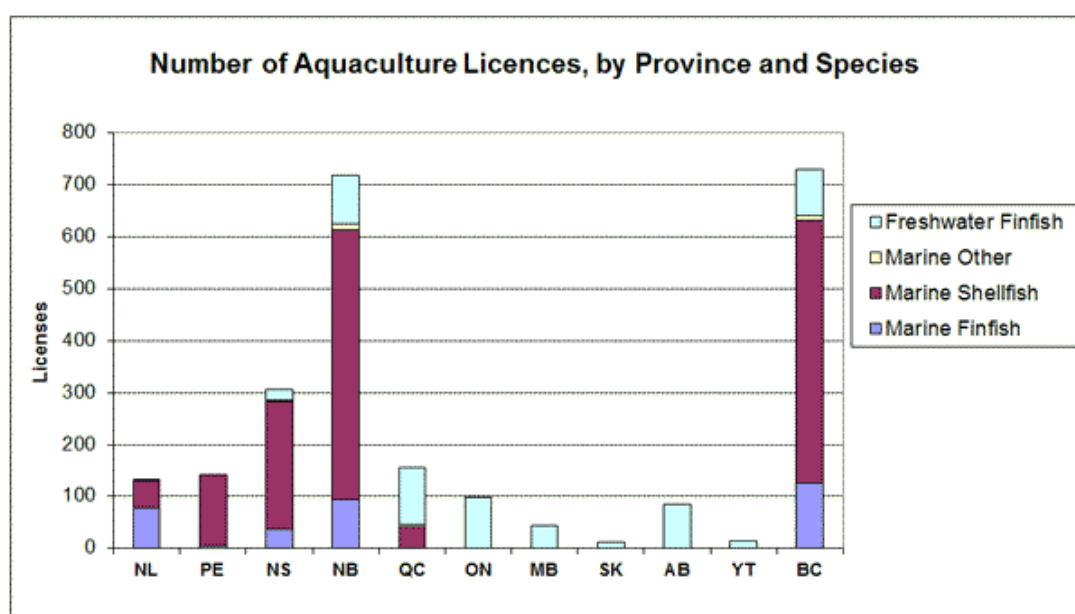


Figure V: Number of aquaculture licences in Canada by province and species (DFO 2013g).

2.5.3 Additional plans and strategies

2.5.3.1 The National Aquaculture Strategic Action Plan Initiative

The National Aquaculture Strategic Action Plan Initiative (NASAPI) was developed by the CCFAM in 2010. This overarching document presents a framework for aquaculture across the country for 2011 to 2014 (CCFAM, 2010). The document highlights three areas of action: (1) Governance; (2) Social Licence and Reporting; and (3) Productivity and Competitiveness. The NASAPI suggests aquaculture growth through MOUs and stakeholder consultation, while maintaining sustainable development; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (CCFAM, 2010, p. 5). This document, however, is not a plan in itself, but rather describes how planning, siting, and development of aquaculture in the country should be carried out.

2.5.3.2 The Nova Scotia Aquaculture Strategy

The former Minister of Fisheries and Aquaculture, Sterling Beliveau, claims the Nova Scotia Aquaculture Strategy (NSAS) “demonstrates [the province’s] commitment to ensuring aquaculture happens in a sustainable way” (Government of Nova Scotia, 2012, p. 1). The 24-page document fails to outline how the province defines sustainability, despite referring to it 25 times. The NSAS is one driven primarily by economic incentives, as is outlined in its sub-title, “Creating Sustainable Wealth in Rural and Coastal Nova Scotia” (Government of Nova Scotia, 2012). The province claims:

Even a modest increase in aquaculture leases could move the industry from a value of [CAD]\$40-50 million, with limited local fish processing, to one triple that value, with one or more new processing operations, investments of millions, and hundreds of direct jobs along the value chain.

(Government of Nova Scotia, 2012, p. 3)

The NSAS functions by way of four pillars: (1) Farming Responsibly; (2) Aquaculture Engagement; (3) Regulatory Safeguards; and (4) Jobs and the Economy. Though there are

numerous plans and strategies related to aquaculture development – on an international, a national, and a provincial level – the Nova Scotia government has struck the Independent Aquaculture Regulatory Review for Nova Scotia Panel to develop a regulatory framework for all aquaculture in the province; perhaps an indication that there is a governmental understanding that the Nova Scotian “aquaculture industry has outgrown the existing legislation and regulations” (Aquaculture Review, n.d., para. 2). The Panel is, in part, a commitment to encompass the themes set out by the Nova Scotia Aquaculture Strategy. The province uses strong language to explain the processes and goals to be attained through the independent review:

The Panel will lead the development of this framework through a process that is independent, transparent, consultative, collaborative, analytically rigorous and evidence-based. The outcome of this initiative will be a regulatory framework that meets the highest standards of effectiveness while balancing the interests of industry, other marine users, local communities, and environmental protection.

(Aquaculture Review, n.d., para. 4)

2.5.3.3 The Nova Scotia Coastal Strategy

The goal of the Nova Scotia Coastal Strategy (NSCS) is to “more effectively manage [the] coastline, one of the provinces most valuable resources” (Government of Nova Scotia, 2011, para. 2). The NSCS draft highlights Leadership and Collaboration, Sustainability, Informed Decision Making, Accountability and Transparency, Diversity, and Stewardship as the guiding principles. Seven key issues being called to action include: (1) Coastal Development; (2) Working Waterfronts; (3) Public Coastal Access; (4) Sea Level Rise and Storm Events; (5) Coastal Ecosystems and Habitats; (6) Coastal Water Quality; and (7) Governance. The last activity on the draft was public commentary dated January 2012 (Government of Nova Scotia, 2011). The working group drafting this document, however, has since been dissolved with pertaining jobs moved outside of Halifax, and therefore the existing knowledge base is no longer accessible. Thus, there is currently no overarching coastal framework for the province that would provide guidance for coastal development, including that for aquaculture.

2.5.3.4 Planning and zoning

Regional and municipal plans have the ability to influence what happens on land. Municipalities in Canada have no jurisdiction past the high-water mark. However, aquaculture is not solely a marine operation. As such, municipalities can influence development within their sphere of influence through land-use bylaws, though this influence does not extend to sea-based aquaculture.

The Eastern Scotian Shelf Intergraded Management Plan (ESSIM) is part of the global Marine Spatial Planning Initiative (UNESCO, 2014). The plan includes 325,000 square kilometres of ocean and included the collaboration of marine transport, oil and gas, energy, commercial fisheries, mariculture, and military sectors. Though the plan was complete in 2008 after 10 years of work, it has yet to be approved by DFO. The United Nations Educational Scientific and Cultural Organization (UNESCO) (2014) claims this lack of approval paired with agency rivalries and hierarchical conflicts makes for a weak strategic and advisory plan, even though the plan has been identified as important and needed:

The area was selected for integrated ocean management because of its important living and non-living resources, high biological diversity and productivity, increasing levels of use and competition for ocean space and resources, and growing concern around human pressures on the marine environment.

(UNESCO, 2014, para. 2)

Similar to the SFA zoning, the DFO has also zoned aquaculture zones in Atlantic Canada (Figure VI: Parliament of Canada, 2010). These zones were decided upon review of environmental data, including physical properties of these areas *e.g.* harsh weather conditions in Zone 6 and Zone 7.

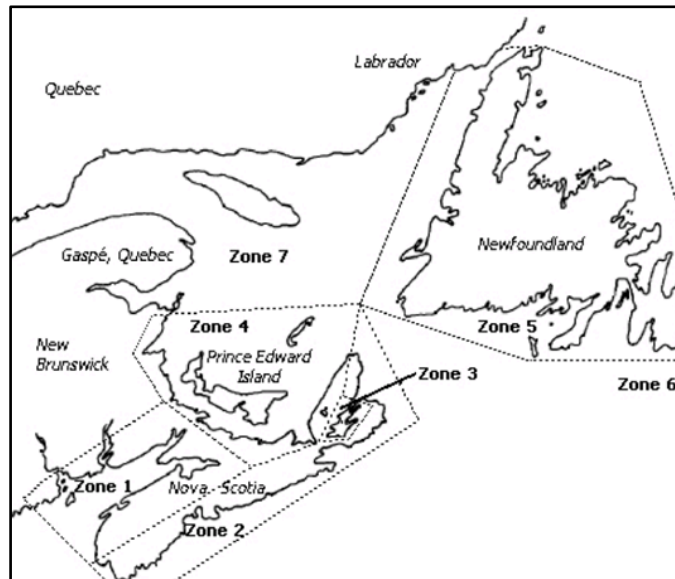


Figure VI: Aquaculture zones in Eastern Canada (Atlantic) (Parliament of Canada, 2010).

2.6 The Eastern Shore of Nova Scotia

The Eastern Shore of Nova Scotia encompasses everything between the north-eastern outskirts of Halifax to the Canso Causeway (Figure VII: Government of Nova Scotia, 2014a). This particular area is marketed to visitors as the shore to which one escapes: escapes to a different time, pace, and way of life (Three Shores Nova Scotia, 2014). For the purpose of this thesis, electoral district statistics were used to synthesize demographic and labour data for the Eastern Shore region (see: Government of Nova Scotia, 2014b). Electoral districts 20: Guysborough-Eastern Shore-Tracadie and 21: Eastern Shore (Figure VIII: Government of Nova Scotia, 2014b) were used as they best describe the geographical area referred to as the Eastern Shore. The population of these districts, according to the 2011 Census, is 28,417 people. Generally speaking, the Eastern Shore region is comprised of an aging population, whereby 39.75 percent of the population is above 54 years-of-age, and 22.75 percent over 65 years-of-age. Most individuals live in family units in owned housing. The average individual and family income for the Eastern Shore region is CAD\$29,555.50 and CAD\$60,882.50, respectively. That being said, the Guysborough-Eastern Shore-Tracadie district income is comparatively lower than that of the Eastern Shore district: CAD\$25,088 vs. CAD\$34,023 individual and CAD\$51,558 vs. CAD\$70,207 household income respectively. Almost 50 percent of Eastern Shore residents holds some version of a post-secondary certificate or degree, though 29.45 percent have

not attained their high school degree or equivalent. It is not clear if these statistics include those below the age of majority in Canada. The unemployment rate in 2011 for individuals 15 years-of-age and older for the Eastern Shore region is 9.65 percent. The Eastern Shore district demonstrated a much lower unemployment rate of 5.4 percent comparative to that of the Guysborough-Eastern Shore-Tracadie district at 13.9 percent, which is higher than both the average Nova Scotian (10 percent) and Canadian (7.8 percent) unemployment rates. Labour by sector is not formally recorded for the Eastern Shore, though it is suspected the main sectors of employment are fisheries and tourism, as outlined by formal interviews and informal conversations with residents.

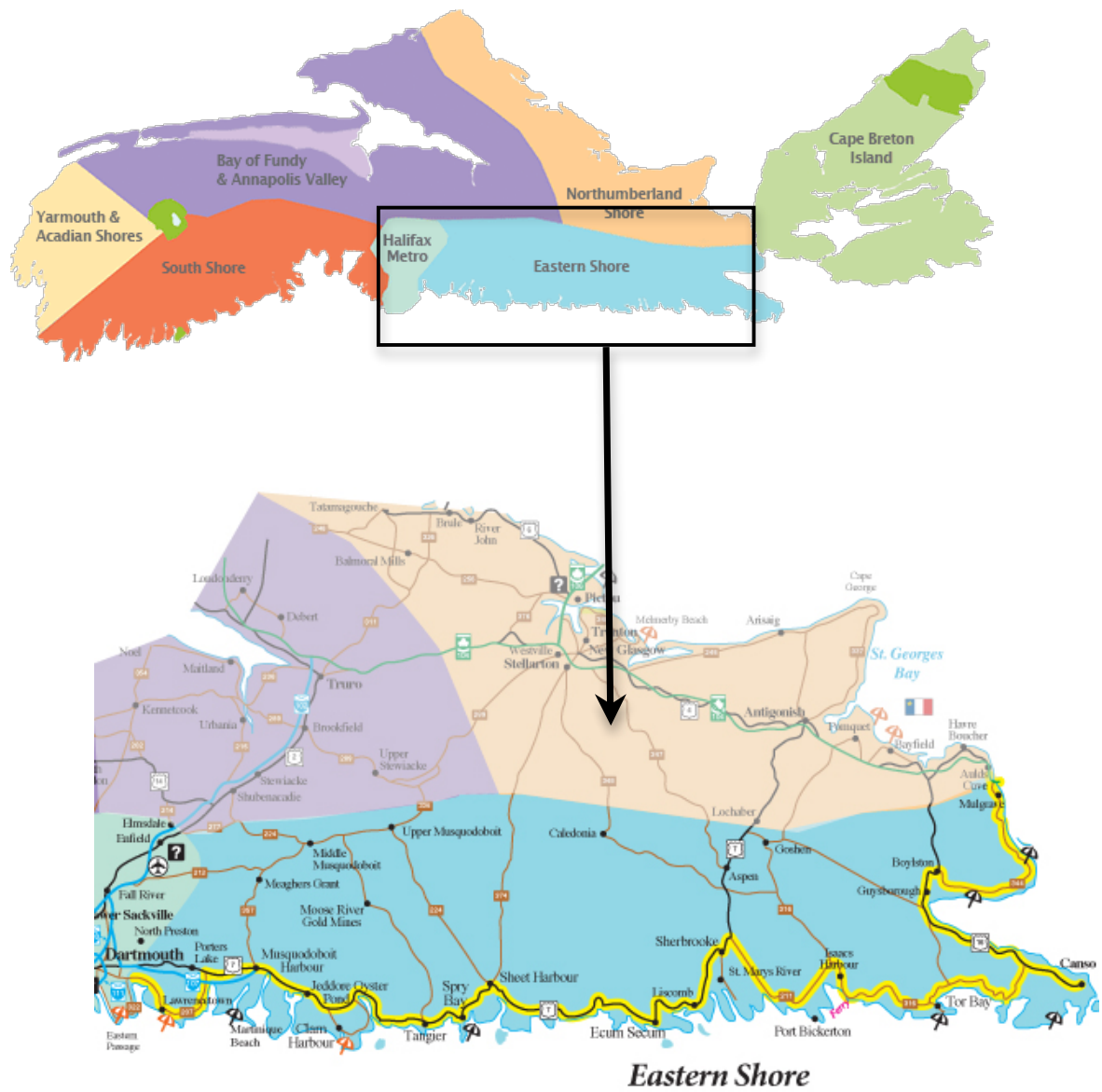


Figure VII: The Eastern Shore of Nova Scotia (Government of Nova Scotia, 2014a).

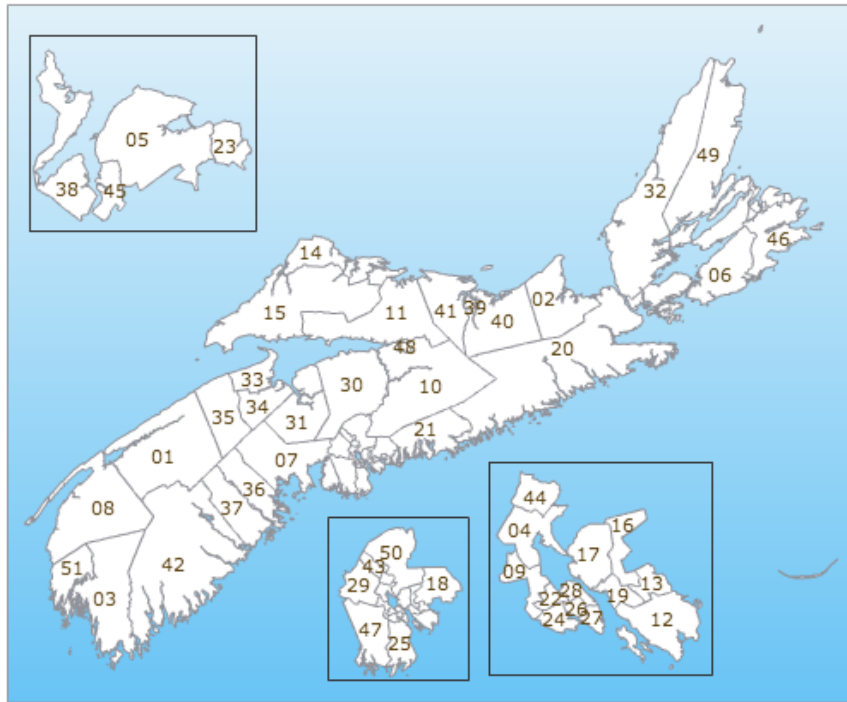


Figure VIII: The electoral districts of Nova Scotia. For the purpose of this thesis, the Eastern Shore region is represented by electoral districts 20 (Guysborough-Eastern Shore-Tracadie district) and 21 (Eastern Shore district) (Government of Nova Scotia, 2014b).

2.6.1 Salmon aquaculture along the Eastern Shore of Nova Scotia: a timeline

As reported by residents and business owners, salmon aquaculture along the Eastern Shore has been present since before the 1980s, and thus has been present in these communities for the last 30-plus years, though on a smaller industrial scale.

Snow Island Salmon (further referred to as Snow Island) operates under the Scottish-based company, Loch Duart Ltd. There is one Atlantic salmon farm in operation under this name in Nova Scotia, located at Owl's Head (Snow Island, n.d.a). An excerpt from Snow Island's official website summarizes their claim to uniqueness within the salmon farming industry:

Snow Island's farm at Owl's Head began operations in 2008 and we are pleased to report we have had no sea lice (*Lepeophthirus salmonis*), no fish escapes, and environmental testing shows no cumulative impact to the seafloor.

(Snow Island, n.d.b, para. 2)

In 2011, the company applied for three additional leases to operate farm sites in the general vicinity of their existing farm along the east coast of the province: one in Spry Harbour; one in Shoal Bay; and one in Beaver Harbour. In November of 2012, Snow Island withdrew its application for a lease in Beaver Harbour, supposedly due to the site's proximity to wild salmon migration routes ("Salmon farm plan", 2012).

In March, 2013, after a 22-month review process, the Nova Scotia government denied the application for the Shoal Bay site based on the DFO's scientific response report (DFO, 2013h). In the conclusions of their report, the DFO found that modeled deposition rates for the proposed site exceeded the recommended rate ($5 \text{ g C m}^{-2} \text{ d}^{-1}$), though all areas of deposition were under $10 \text{ g C m}^{-2} \text{ d}^{-1}$. The report also declared – after a 2012 salmon Recovery Potential Assessment (RPA) – in the review of any aquaculture development, consideration should be given to the risk of extirpation of wild salmon populations in the province. The report described other commercial fisheries in the area with uncertainty primarily around lobster larvae statistics for the Bay, though did conclude presence of larvae "very likely" from July to September. The approval for the remaining Spry Harbour site is pending an outstanding assessment.

Since the commencement of this study, Snow Island has removed the cages at Owl's Head and is reconsidering their operation, as their plans included multiple sites; key in implementing their rotating model (Snow Island, n.d.c). The Snow Island rotation model is comprised of three distinct periods: (1) Input, where smolts enter the pens and grow for nearly 18 months; (2) Harvest, where fish continue growth and are selected periodically through a 12-month period for harvest; and (3) Fallow, where no fish or equipment is in the water for a total of 18 months. Through this model, not all sites are operational at one given time, concluding multiple sites are needed in order to sustain work and income.

2.7 Aquaculture and social conflict in Atlantic Canada

The social license to operate within the aquaculture business in Atlantic Canada has varied greatly over the years. The nature and extent of conflict surrounding aquaculture operations vary widely both in terms of the environmental and socio-economic setting in which the aquaculture site is proposed, and of the forms of culture involved.

Finfish aquaculture in Prince Edward Island is conducted in pond cages and land-based tanks (Department of Fisheries, Aquaculture and Rural Development, 2008). The Atlantic salmon industry is hatchery-based, and thus there are no saltwater-based finfish grow-out sites. Therefore, no studies have been conducted on social conflict as in other Atlantic provinces, as the conflict with salmon aquaculture is non-existent. The mussel aquaculture industry in Prince Edward Island is the largest and most economically successful in all of Canada (Discover Mussels, 2014), though this industry has also seen its share of conflict. In a 2005 interview (Porter), veteran mussel farmer John MacLeod and Richard Gallant, aquaculture section manager, describe their experiences with the development of the Prince Edward Island mussel industry. In the beginning of development, the province aimed to zone bays, suitable or not, for the development of mussel farms. Even with such planning, some bays ended up choked with farming gear.

MacLeod [...] recalled a time when there were used plastic jugs being used as floats, sandbags used to hold down lines, and lines run so thick that navigation in some bays was difficult. The density of mussel gear vexed some waterfront property owners in Tracadie, he said.

(Porter, 2005, para. 19)

Solutions to gear issues were grassroots. The mussel farming industry took initiative to meet with locals to reach agreements on how business should be conducted.

According to Gallant, that was how many local disputes were resolved in the early days of the industry. Growers, he said, “live in the community and work in the local community.” That means that many conflicts can be resolved among neighbors.

(Porter, 2005, para. 20)

That being said, both also understand that small, local growers are being bought up by larger companies, consolidating the industry in Prince Edward Island. Such changes will likely lead to changes in the way future consultation is conducted.

The provincial government of Newfoundland and Labrador carried out a study (n.d.) which examined social conflicts within two aquaculture study areas: Green Bay South (mussel aquaculture) and Bay D’Espoir (finfish aquaculture). The majority of primary complaints were coming from the fishing communities (58 percent) and residents or land owners (42 percent). Opposition in these areas was organized through community groups, where regular meetings took place. Main concerns included aesthetics, navigation safety, and environmental pollution, while inshore fisheries were concerned with access to traditional fishing grounds. Specific concerns described further within the text were identified as:

- Shorefast Moorings;
- Fishery-Related Conflicts;
- Site Set-Up and Marking;
- Interest Group Consultation;
- Site Inspection and Regulation Enforcement;
- Lack of Industry Awareness;
- Site Maintenance/Aesthetics;
- Public Notice Procedure;
- Appeal Process;
- Environmental Considerations; and
- Land (Water) Use Planning.

In New Brunswick, there was considerable opposition from lobster fishermen towards salmon aquaculture around Grand Manan and Deer Island (Walters, 2007). Main concerns in this area during this study that took place from 2002 to 2003 included the entanglement of fishing gear. In this case, however, only 31 percent of fisherman interviewed had a general negative opinion towards salmon aquaculture. Though fishermen were concerned about the displacement of their fishery, the main concern was the health of the surrounding environment and of the lobster, mainly to do with the potential use of the chemotherapeutant food additive SLICE that is used to combat sea lice. Additional concerns included those related to corporate control over the industry, resulting in unfair lease agreements.

There has been considerable opposition to aquaculture throughout Nova Scotia going back many years (Bailey, Jentoft & Sinclair, 1996). The nature of such conflicts concerned property rights – including coastal property values and historical lobstering areas, access to coastal resources, and pollution of the marine environment (Swire, 1990 and Johnson 1991 in Bailey, Jentoft & Sinclair, 1996). Opposition to salmon aquaculture specifically is organized through existing or newly formed ENGOs and community groups (EAC, n.d.; APES, n.d.; WWF, 2014). These groups claim issues such as environmental, fish, and human health concerns, and have called for a moratorium on the development of the industry within the province, and Atlantic Canada. Bailey, Jentoft & Sinclair (1996) claim it is the weakness of aquaculture property rights within the Nova Scotia government that is partly to blame for the lack of development, where in New Brunswick, aquaculturists are more empowered to operate thanks to the stronger existence of property rights within the province's Department of Fisheries, which includes the aquaculture sector.

Though the Eastern Shore is experiencing difficult financial situations, Nova Scotia is struggling as a whole, whereby rural areas are particularly at risk. The Report of the Nova Scotia Commission on Building Our Economy was released February 12, 2014, and outlines challenges and areas of opportunity for economic prosperity. Existing industries, such as tourism, agriculture, fisheries and mining, are highlighted as an important backbone on which Nova Scotian rural communities thrive. The conflict with sea-based grow-out aquaculture was mentioned throughout the document, though the importance of the industry was also highlighted. The province was commended for commencing regulation reform within the entire industry:

Building a strong aquaculture sector will also be of increasing importance to communities around the province seeking to exploit fish production, given the limits to growth of wild fish stocks.

(Ivany *et al.*, 2014, p. 95)

2.8 Research objectives

This thesis aims to: (1) Analyze the discourse surrounding Canadian finfish aquaculture as it has been presented by the Canadian media over the last year through a formal media analysis; (2) Describe the nature and extent of any perceived existing or potential conflict with aquaculture development along the Eastern Shore of Nova Scotia through semi-structured interviews of workers (fisheries, tourism, aquaculture), residents and recreationists, ENGOs, and policy makers and planners of/for the Eastern Shore; and (3) Present recommendations and next-steps towards alleviating conflict and fostering prosperity in rural Nova Scotian coastal communities, using the Eastern Shore as a case study.

3 Methodology

This detailed methodology section describes the mixed-method approaches used for both data collection and analysis for all three data sources: (1) Media analyses; (2) Interviews; and (3) Community meetings.

3.1 Media analysis

The methods used in the media analysis included both an article analysis and a spokesperson analysis as outlined by Gould, 2004. The Communications Consortium Media Center (Gould, 2004) methodology was chosen in order to understand the broad messages being portrayed to the Canadian public in regards to both aquaculture in general, and more specifically, salmon aquaculture, through an article analysis. By way of a spokesperson analysis, key voices were teased out of the information in order to better understand whom such articles primarily voiced.

3.1.1 Selection criteria

3.1.1.1 Developing list of news outlets

As per Gould (2004), the top ten daily newspapers, top two nationally distributed papers, three national news magazines, six national broadcast outlets, two wire services, and one Internet news source were identified for article searches. The search contained outlets in both official Canadian languages, French and English. The selected newspapers, magazines, and outlets differed from Gould (2004), as the report listed American rather than Canadian sources. Canadian newspapers, magazines, and outlets were identified through Newspaper Canada's 2012 Circulation Report that utilized the Audit Bureau of Circulation (ABC), the Canadian Circulation Audits Board (CCAB), the Canadian Media Circulation Audit (CMCA), and publisher claims for presented data. Only two, rather than the suggested three, national news magazines were identified through Masthead's 2011

Top 50 Canadian Magazines Report (Hayward, 2012), also derived from the ABC's statistics. Channel Canada's (2013) website was used to identify the six national broadcast outlets. The two wire and Internet services were determined through Google searches as "Canadian news wire services" and "Canadian Internet news", respectively, and the first results were chosen.

3.1.1.2 Search criteria

Once the news providers were selected, a specific timeline was determined. Though Gould (2004) suggested a six-month timeframe, articles over a one-year timeframe were analyzed due to low hits on searches for a smaller time period. The media analysis began in August 2013, and articles published between August 31, 2012 and July 31, 2013 were analyzed.

Article searches were carried out using both Google News searches, as well as searches on the specific news-provider sites. Deviation from Gould's (2004) database suggestions again relate to the geographic differences in scope. Article search terms included: "aquaculture", "salmon aquaculture", "fish farm", "salmon fish farm" and "net-pen". Only articles focusing on aquaculture in general or salmon aquaculture in particular were used for analysis. In other words, any article that spoke specifically about any other type of aquaculture (*i.e.* other finfish, shellfish, aquatic plants), without speaking to salmon aquaculture, was excluded. Additional irrelevant articles, such as those that mentioned search terms out of context, were disregarded (Gould, 2004). As results fell under the 300-article/broadcast range, random sampling was not needed to reduce sample size, as suggested by Gould (2004).

3.1.2 Analytical process of article analysis

There were four main steps in analyzing the articles themselves (Gould, 2004). Firstly, the articles were read thoroughly and classified by type as opinion (*e.g.* columns, editorials), news (*e.g.* current events), or feature (*e.g.* profiles). The time of release was then recorded and analyzed based on calendar year and at-the-time events. Note of where each story was presented within its source was also important in determining how a given outlet portrayed the story (*e.g.* front page *vs.* environment *vs.* business). Lastly, themes were identified for

each article and broadcast to determine the overall tone of the provided information. Themes can further help to identify the framing of a story, possibly reflecting a specific view on the topic being covered.

3.1.3 Spokesperson analysis

As the articles were read, the number and types of spokespersons were outlined. Spokespersons were categorized as: (1) Advocates; (2) Business Leaders (in aquaculture); (3) Government Officials; (4) General Public; and (5) Academics, as per Gould (2004). Government Officials were further broken down to Government Officials (International), Government Officials (Canada), and Government Officials (Provincial), to reflect the different levels of government being presented, leading to a total of seven types of spokespersons. The academics sector was also expanded to include other experts, such as in law *e.g.* judges.

A quote was considered a quote when: (1) Actual quotation marks identified the speaker, or (2) The name of the individual either pre- or proceeded explanatory text without a direct quotation *e.g.* “According to Smith...”. If a quote was pre- or proceeded with explanatory text, the additional text was counted as an additional quote only if the explanation added any additional information to the direct quotation, rather than reiterating.

3.2 Interviews

The interview questions were created in order to explore the nature and extent of perceived conflict with salmon aquaculture along the Eastern Shore of Nova Scotia. As such, the first questions did not assume perceived conflict, rather, they were designed in order to find out how the interviewee identified with the Eastern Shore, eliciting personal key words or themes regarding salmon aquaculture in general, while determining whether or not the interviewee perceived conflict. The initial series of questions were submitted to the Dalhousie Ethics Review, through which prompts were created should the interviewee require further information in order to answer the question completely with confidence.

The Dalhousie Ethics Review was needed since one of the thesis supervisors is a faculty member at the institution.

3.2.1 Selection criteria

The original study population included adults working in and using the coastal zone of the Eastern Shore of Nova Scotia: (1) Aquaculture (3 interviewees); (2) Inshore Fisheries (2-4); (3) Offshore Fisheries (1-2); (4) Ocean-based Tourism (2-3); (5) Inland Tourism (1-2); (6) Landowners/Residents (2-4); (7) Recreationists (1-2); (8) Local ENGOs (1-2); and (9) Planners and Policy Makers (1-2).

Offshore fisheries were later removed as a sector since this industry is practically non-existent in this part of the province. Recruitment was conducted through initial contact and snowballing, or reference sampling (Heckathorn, 2011). Initial contacts were identified through primary contact of particular interest groups such as lobstermen's associations, or companies (as for tourism and aquaculture) through contact information available on official websites, and through personal contact of interested parties at community meetings. This initial group is known as a convenience sample, whereby the hard-to-reach individuals were then able to be contacted (Heckathorn, 2011). This sampling method is justified where those with specific ties to the coastline were being sought out, rather than a random sample of the general population.

3.2.2 Interview process

As per the Dalhousie Ethics Review, all participants were presented with a formal consent form outlining the details of the study and a signature page granting permission to audio record the interview, and re-contact information, should direct quotations have been requested. The participants were also informed that the findings, and potentially raw data, would be leaving the country, as the corresponding university is located in Iceland. The interviews were conducted in a semi-structured fashion (Bernard, 2006), such that questions were asked and participants replied with as much or as little information as they wished. All but two interviews were face-to-face. The other two were conducted over the

phone due to scheduling issues brought on by poor weather conditions that resulted in restricted travel opportunities to communities along the Eastern Shore. In these two cases, consent was given verbally.

A grid sheet was used to outline the identified stakeholders along the Eastern Shore. When asking about perceived conflict, participants were prompted either verbally, or both verbally and visually, with the grid sheet. The purpose of the sheet was to quantify responses and for all participants to consider the same stakeholders in their reflections and responses. The grid sheet also provided participants with the opportunity to identify any stakeholders that they felt were left out.

Participants who identified conflict were also asked to visually map out in which communities they perceived this conflict, a method known as participatory mapping (Emmel, 2008). They did so by mapping either directly on Google Maps when an Internet connection was available, or on printed maps (also provided from GoogleMaps) when the online version was not available. The printed maps illustrated the entire Eastern Shore, and magnified areas along the shore, as is possible with the online version. For the two phone interviews, the process of mapping was verbally explained and the participants listed communities or points on the map in which they perceived conflict, though the points were mapped directly on to GoogleMaps on behalf of the participants.

3.2.3 Interview analysis

Nvivo10, a mixed-methods analysis tool, was used to analyze the interview data, specifically regarding the concerns, or nature of the perceived conflict. The interviews were manually coded, using nodes, directly onto the audio timeline, such that transcripts were not needed as word frequency and text search options were not being used (a “node” is the word or phrase said or described upon within the interview) (Nvivo, n.d.). After interviews were manually coded, the information was quantifiable and common themes were identified among participants. The nodes were reorganized to fit within common larger themes so they may be compared to those brought up in the community meetings. The nodes were then visually aggregated into a word cloud using Wordle, a free online program. A word cloud is a visual representation of qualitative data that enlarges the most

frequently used words or phrases proportionally to others. Though word clouds are a popular tool to represent numerous points that may be overwhelming through another presentation tool, such as graphs, colour, white spacing around lettering, and placement within the cloud may influence the apparent emphasis (Hein, 2012).

The information provided in the stakeholder grid sheets was already quantifiable and was summarized in one table.

The GoogleMaps polygon data were converted to KML files, readable by ArcGIS mapping software. ArcGIS was then used to overlay the areas of perceived conflict identified by the participants, visualizing the spatial data and illustrating communities in which higher levels of conflict are perceived.

3.3 Community meeting analysis

The Doelle-Lahey Panel (further referred to as the Panel) is currently conducting the Independent Aquaculture Regulatory Review for Nova Scotia. From July to September 2013, the Panel facilitated community meetings across Nova Scotia where residents were encouraged to share their concerns related to the aquaculture industry and provided recommendations contributing to regulation reform across all forms of aquaculture. The Panel released its detailed community meeting notes in January 2014 (see: aquaculturereview.ca). The meeting notes outlined the discussions verbatim by participants. The notes from the Eastern Shore participants were analyzed using Nvivo10. The transcripts of the above-described meetings were entered into the program and were then manually coded in order to highlight any existing, or catch any new, nodes. The limitation in comparing the community notes with interview responses concerns the way in which the data were collected such that community meeting participants were not prompted by questions, but were rather asked open-endedly to contribute to the discussion, thus making it more difficult to pick out what were considered concerns. Additionally, the community meetings regarded total aquaculture regulatory reform, rather than solely salmon or finfish aquaculture. That being said, the majority of concerns expressed related

specifically to sea-based finfish aquaculture such that terms and themes were more easily identifiable.

4 Results

4.1 Media analysis

4.1.1 Article analysis

The original sample contained 86 written articles and 13 broadcasts. Upon further analysis, 12 articles were removed, as they did not fit the methodological criteria. An additional seven broadcasts were removed, as the recordings were no longer available online, and no response was received from the stations when requests were made. Thus, the sample contained 74 written articles, and six broadcasts, for a total of 80 pieces. The papers and stations included: CBC News (14 pieces); Vancouver Sun (13); The Globe and Mail (10); CTV News (9); Toronto Star (9); Global News (5); La Presse (4); McLean's (3); City News (2); Montreal Gazette (2); National News Wire (2); Ottawa Citizen (2); Winnipeg Free Press (2); Calgary Herald (1); Toronto City News (1); and Toronto Sun (1). The articles and broadcasts covered various sections, where the most common included: National News (32); Regional News *e.g.* Provincial News (14); and Health and Life (14) (Figure V). The majority of the articles and broadcasts were News (67 pieces), followed by Feature (7) and Opinion (6) pieces.

Six of the articles were printed in more than one publication, thus a total of nine articles are considered duplicates. Duplicate topics were still recorded as they enabled the given story to reach a wider audience.

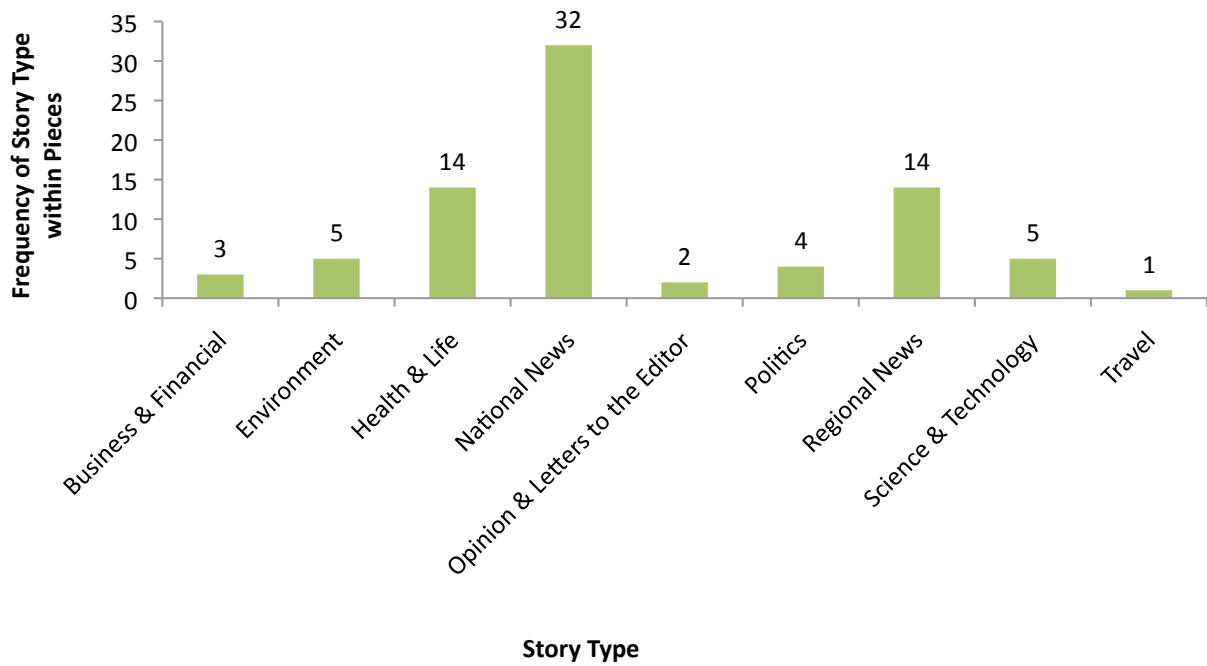


Figure IX: Story types of aquaculture-related pieces within a media analysis conducted on Canadian pieces from August 1, 2012 to July 31, 2013.

4.1.2 Topic analysis

There were 18 main topics across the articles and broadcasts. Individual pieces covered one to four topics, and 38 covered more than one. The most commonly discussed topics were “Disease” (28 pieces), followed by “Wild Salmon” (20), and “Policy and Regulations” (14) (Figure X). The most popular paired topics included “Wild Salmon” and “Policy and Regulations” (9 pieces), followed by “Disease” and “Wild Salmon” (8), “Disease” and “Human Health” (5), and “Human Health” and “Wild Salmon” (5).

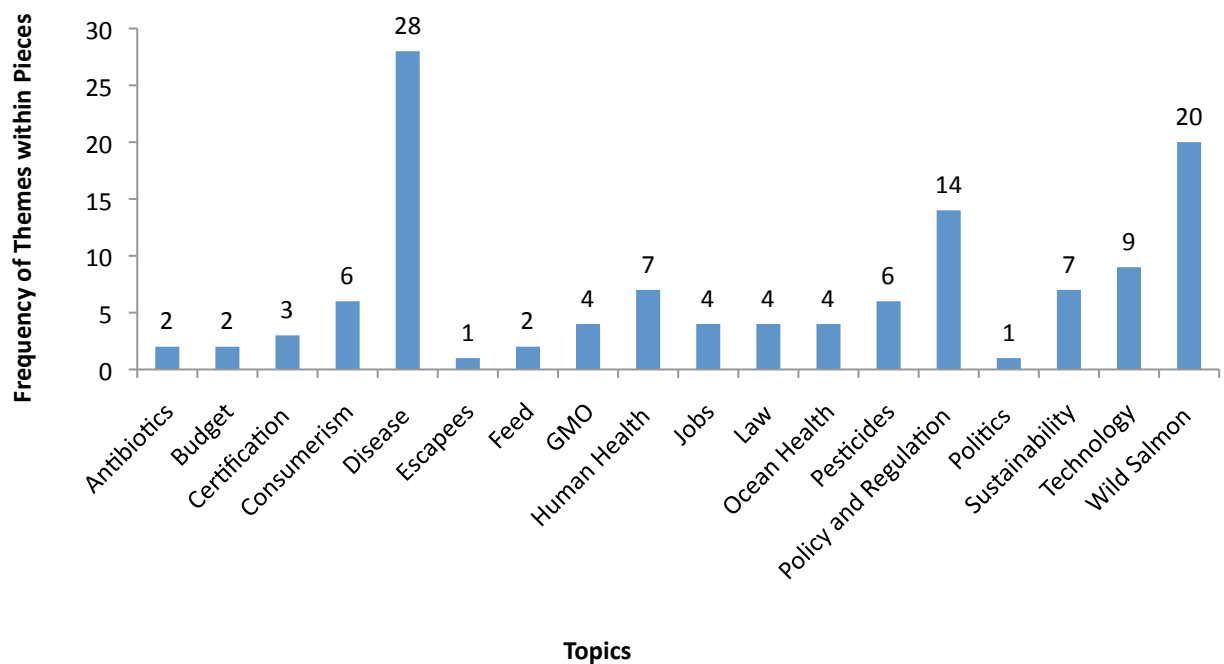


Figure X: Themes within aquaculture-related pieces within a media analysis conducted on Canadian pieces from August 1, 2012 to July 31, 2013.

4.1.3 Spokesperson analysis

All but one article contained at least one direct quotation from at least one spokesperson. The most common type of spokesperson quoted in the articles or broadcasts included: Academics and Experts (40 pieces); Advocates *e.g.* Community Leaders (35); and Business Leaders (Aquaculture) (35). The total number of individuals quoted across the 80 pieces was 237, for a total of 659 quotes (Figure XI).

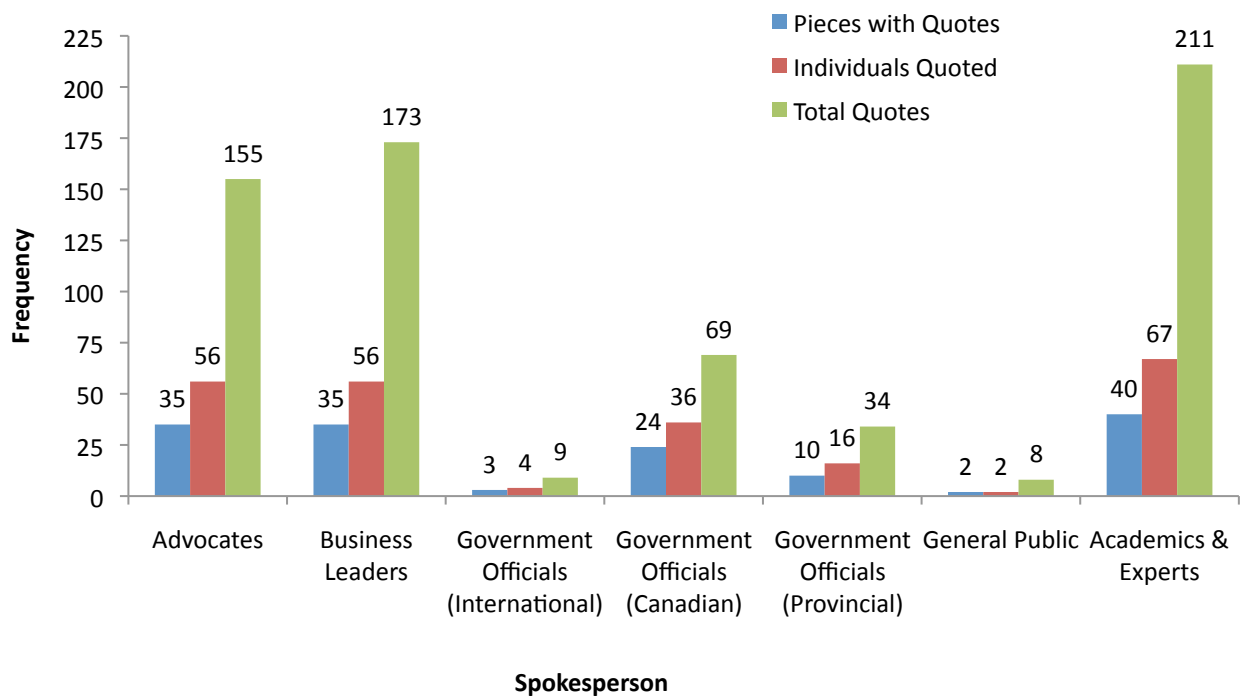


Figure XI: Pieces with quotes, individuals quoted, and total quotes within aquaculture-related pieces within a media analysis conducted on Canadian pieces from August 1, 2012 to July 31, 2013.

4.2 Community meeting review

There were three main communities within the Eastern Shore in which these meetings took place (Figure XII: Doelle-Lahey Panel, 2013): Oyster Pond, Sheet Harbour, and Guysborough, with a total of 74 attendees. Concerns spanned various categories including:

Waste from salmon farms; the impact of salmon farms on wild salmon and lobster stocks, and therefore on economic activities dependent on each; the use of pesticides and pharmaceuticals in salmon farming; concerns about human health; the impact of aquaculture on tourism; and the consequences of aquaculture for recreations activities and the natural beauty of the coastline.

(Doelle-Lahey Panel, 2013, p. 3)

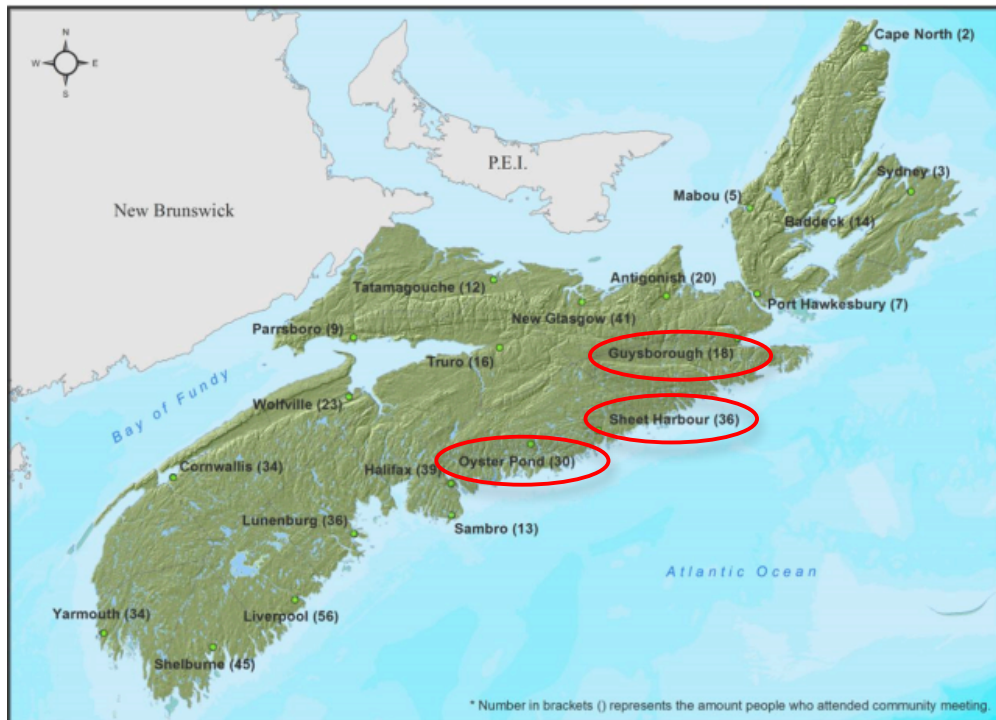


Figure XII: Communities in which the Panel's community meetings regarding aquaculture regulatory reform took place from July to September 2013 with attendee numbers in brackets. The communities representing the Eastern Shore are circled in red (modified from Doelle-Lahey Panel, 2013).

4.2.1 Eastern Shore community meetings

Of the 74 attendees across the three meetings, there were 51-53 speakers. Within one of the meetings, there were three "Unidentified Speakers", though the meeting notes did not outline if this was one, two, or three individual(s). There were 12 female, 37 male, and 2-4 unidentified speakers. Of the identified speakers, three were also formally interviewed for the purpose of this study. The concerns voiced in the meetings were broken down into the following five categories, as to match those of the interviews (Table IV).

Table IV: Identified issues within the Panel's community meetings along the Eastern Shore of Nova Scotia regarding aquaculture regulatory reform took place from July to September 2013. Numbers represent the frequency of community meeting participants that mentioned a topic under a given issue. A participant was counted more than once for a given issue when he or she mentioned more than one topic that fell under the same identified issue.

Community	Identified Issues				
	Negative Environmental Change	Negative Economic Impact	Governance & Institutional Issues	Poor Industry Etiquette & Ethics	Human Health Concerns
Sheet Harbour	33	19	25	9	5
Oyster Pond	25	9	17	8	0
Guysborough	11	11	8	3	0
TOTALS	69	39	50	20	5

4.3 Interviews

A total of 12 interviews were conducted across eight sectors: (1) Aquaculture; (2) Inshore Fisheries; (3) Ocean-based Tourism; (4) Inland Tourism; (5) Landowners/Residents; (6) Recreationists; (7) ENGOs; and (8) Planners and Policy Makers. Ideally, two additional interviews would have been conducted with representatives from the salmon aquaculture industry along the Eastern Shore, but no contact could be made with the company's representatives despite a number of requests.

Of the 12 interviewees, five were female and seven were male. Represented communities included Baker's Point, Canso, Dartmouth, Sheet Harbour, Ship Harbour, Spry Harbour, Tangier, Head of Jeddore and the Eastern Shore as a whole.

Although most interviewees identified with a particular sector, some identified with more than one sector (Table V).

Table V: Sectoral affiliations of interviewees from the Eastern Shore of Nova Scotia.

Primary Affiliation	Secondary Affiliation	Tertiary Affiliation
Aquaculturist	Resident	-
ENGO	Resident	Inshore Fishery
ENGO	-	-
Inshore Fishery	ENGO	-
Inshore Fishery	Resident	-
Land-Based Tourism	Resident	-
Ocean-Based tourism	Resident	-
Planner and/or Policy-Maker	Recreationist	-
Recreationist	-	-
Recreationist	-	-
Resident	-	-
Resident	Inshore Fishery	Aquaculturist

4.3.1 Personal associations with salmon aquaculture

When asked about personal associations with salmon aquaculture, seven of the interviewees expressed negative connotations, three expressed positive connotations, two expressed views of economic opportunity and productivity, and two of the interviewees expressed neutral opinions as they had no connection to salmon aquaculture in their communities. One of the interviewees expressed both negative and positive connotations, describing their initial personal reflection as negative, while expressing the positivity of potential economic opportunity and productivity later in the interview. About half (5/12) of the participants described conflict which they had themselves experienced through their day-to-day activities either as residents and/or employees within the Eastern Shore communities, while the others (7/12) described conflict which they perceived within their communities. Interestingly, the majority (67 percent) of interviewees that expressed negative connotations also deliberately described standard salmon aquaculture culture practice as “open” *e.g.* open net-pen farming. Of those interviewed, 75 percent were aware of salmon aquaculture operations in their community.

4.3.2 Perceived conflict by sector

The offshore fishery was removed from the original stakeholder group as this sector is essentially non-existent in the area. Two of the interviewees identified three separate stakeholder groups including: (1) Recreational Fishing; (2) Salmon Consumers; and (3)

Aquaculture (as being in conflict with Aquaculture). The latter being among existing aquaculture companies, particularly salmon aquaculture (Table VI). About half of the interviewees described a butting-of-heads back-and-forth between the aquaculture industry and other stakeholders. Five interviewees described the conflict as one-directional, such that stakeholder groups had the issue with the aquaculture industry, though it was their perception that the industry did not necessarily share the same sense of conflict.

Table VI: Perceived conflict among stakeholders and existing and/or potentially expanding salmon aquaculture along the Eastern Shore of Nova Scotia as described by interviewees. Numbers indicate the frequency of interviewees who indicated the perceived conflict among stakeholders. The colours indicate directional conflict, where blue indicates the aquaculture industry exerting conflict with the listed stakeholder, and green indicating the listed stakeholder exerting conflict with the aquaculture industry. Total numbers indicate total instances of perceived conflict between the salmon aquaculture industry and identified stakeholders.

Stakeholder	Perceived Conflict		Total
Aquaculture	1	1	2
Consumers	1	-	1
Inshore Fishery	5	10	15
Ocean-based Tourism	6	10	16
Land-based Tourism	6	10	16
Landowners/Residents	4	9	13
Recreational Fishery	1	1	2
Recreationists	3	6	9
Local ENGOS	6	7	13
Planners & Policy Makers	3	3	6

4.3.3 Nature of perceived conflict

The nature of the conflict described through the interviews included phrases or narratives that fell under the following seven hierarchies: (1) Negative Environmental Change (49 nodes across 14 themes); (2) Governance and Information Issues (22 nodes across seven themes); (3) Nature of the Industry and Industry Practices (14 nodes across seven themes); (4) Economic Concerns (14 nodes across four themes); (5) Poor Industry Etiquette and Ethics (11 nodes across five themes); (6) Opposition Tactics (seven nodes across two themes); and (7) Human Health Concerns (two nodes across one theme) (Table VII). The originally mentioned terms are visualized through Figure XIII such that the larger words illustrate more frequently mentioned terms.

Table VII: Categorized emerged themes of the nature of perceived conflict as per interviewees. Numbers indicate the frequency of interviewees who mentioned theme (node).

Hierarchy	Original Emerged Theme
Negative Environmental Change	<ul style="list-style-type: none"> Benthic Accumulation (3) Contamination (7) Damage to Existing Fauna (1) Disease (6) Escapees (4) Esthetics (4) Feed (2) Infectious Salmon Anemia (ISA) (2) Kidney Disease (1) Odour (1) Sea Lice (4) Waste (6) Water Pollution (3) Wild Salmon (5)
Governance and Information Issues	<ul style="list-style-type: none"> Biased Information (2) Conflict of Interest (3) Misregulation (2) Misinformation (5) Mistrust of Governments (5) Spatial Conflicts (4) Unaccountability (1)
Nature of the Industry & Industry Practices	<ul style="list-style-type: none"> Antifouling (2) Antibiotics (2) Artificial (1) Newness of Industry (1) Old Technology (1) Pesticides (4) Stocking Densities (3)
Economic Concerns	<ul style="list-style-type: none"> Economic Collapse of Industry (2) Decrease in Wild Product Quality/Value (5) Decrease in Property Values (4) Subsidies (3)
Poor Industry Etiquette and Ethics	<ul style="list-style-type: none"> Lack of Community Engagement (3) Entitlement (1) Lack of Transparency (2) Misinformation (5)
Opposition Tactics	<ul style="list-style-type: none"> Fear (4) Misinformation (3)
Human Health Concerns	<ul style="list-style-type: none"> Unknown Impacts on Human Health (2)

Others saw opportunity in few jobs, as the Eastern Shore population is smaller than the urban centres of Nova Scotia, and needs to take advantage of opportunities where they present themselves.

The bottom line is, there's nothing on the shore here. There's nothing here for the people for work. This would give a few more jobs.

– Glen Bayers, Interviewee

The Eastern Shore, if anyone wants to look closely, it's crumbling and dying. My business, now not all businesses, but it's true of a lot of them, if you drive down here you'll see they're out of business. The Eastern Shore, for me, goes down a little more each year [...] and sometimes people will say 'it'll only create 20 jobs'... ONLY create 20 jobs?! This isn't downtown Halifax where you think only creating 20 jobs, that's nothing, this is the Eastern Shore, oh my God, 20 jobs is a lot on the Eastern Shore!

– Patricia Klavin, Interviewee

Some interviewees expressed the danger in removing opportunities from the Eastern Shore is that those looking for work will head elsewhere; outside of the Eastern Shore, and likely outside of Nova Scotia all together.

And [the provincial government] felt very secure that they wouldn't do anything that would harm the fishery. When you turn around and support a 25 million dollar harvesting facility in your riding, then you think, God this doesn't look good... put stuff in our area and then put the fish down there to get processed; we're not even going to get the jobs out of it.

– Kevin Daniels, Interviewee

Those same people that are in those communities, their kids, they're headed to Alberta.

– Stacey Knowles, Interviewee

Lastly, other interviewees were quite blunt in describing how the demographics of the area may simply be responsible for the seemingly unwillingness to accept change.

People are pretty stayed and opinionated down there, you know.

– Franchesca Rodrigez, Interviewee

That being said, a common theme discussed by interviewees who held either neutral or positive opinions towards the salmon aquaculture industry described the fear or inability of industry supporters to speak up in their own communities.

Because it's so noisy and it's small communities and you end up with nay-sayers being vocal, you don't usually hear from the people who might be supportive, they're afraid to stand up.

– Stacey Knowles, Interviewee

There are people that are supportive. Unfortunately it gets so polarized and so hostile – and this is typically in small rural communities – that those supporters don't speak up, 'cause there's a lot at stake [...] they're afraid, largely. A lot of them have been threatened and intimidated, and it can get quite nasty. So the support is there, but it's quiet.

– Malcom O'Connell, Interviewee

Separate from sentiments of discontentment among individuals within the Eastern Shore communities was a strong attitude of distrust towards various means of information and communication, including government, corporations, Non-Governmental Organizations (NGOs), and mass media.

A lot of people are probably not well informed, just as I am probably not well informed. This is all the media really talks about also, you know, when there's problems.

– Christine Roberts, Interviewee

I think one aspect of the [group's] involvement was met with a response from Snow Island with a slap suite, or potential law suit. [The group] removed that material from their website that Snow Island asked them to [...] that they claimed was defamatory.

– Gregoire Lafrenier, Interviewee

There seems to be a problem with the government people on this [...] so I started calling people at the natural resources and biologists with the province [...] they didn't tell me anything. I got the real supreme run around.

– Colby Thompson, Interviewee

People can get distrustful when the government jumps on board, can't they?

– Patricia Klavin, Interviewee

People are hard pressed to tell the truth all the time. Both sides use things that are not, are not right. If everybody was above board, at least you'd know the truth about what something does or who does what.

– Kevin Daniels, Interviewee

As far as scientists, fishermen don't believe scientists. They haven't believed for years. When they get away from where their job was and get in to the public where they can talk, it's a different story [...] and if you don't believe what I'm saying, then I don't believe what you're saying.

– Kevin Daniels, Interviewee

4.3.4 Spatial perception of conflict

All but one of the interviewees mapped areas along the Eastern Shore where they perceived the most conflict to be present (Figure XIV). There is a concentration in two areas along the Eastern Shore: the area from Ship Harbour to Sheet Harbour, and again further east near Canso. The red zones represent the areas selected by the interviewees, such that the darker the red colour, the more frequent the area was said to be in conflict with salmon aquaculture. These areas of perceived conflict are concentrated around the existing and proposed Snow Island sites.

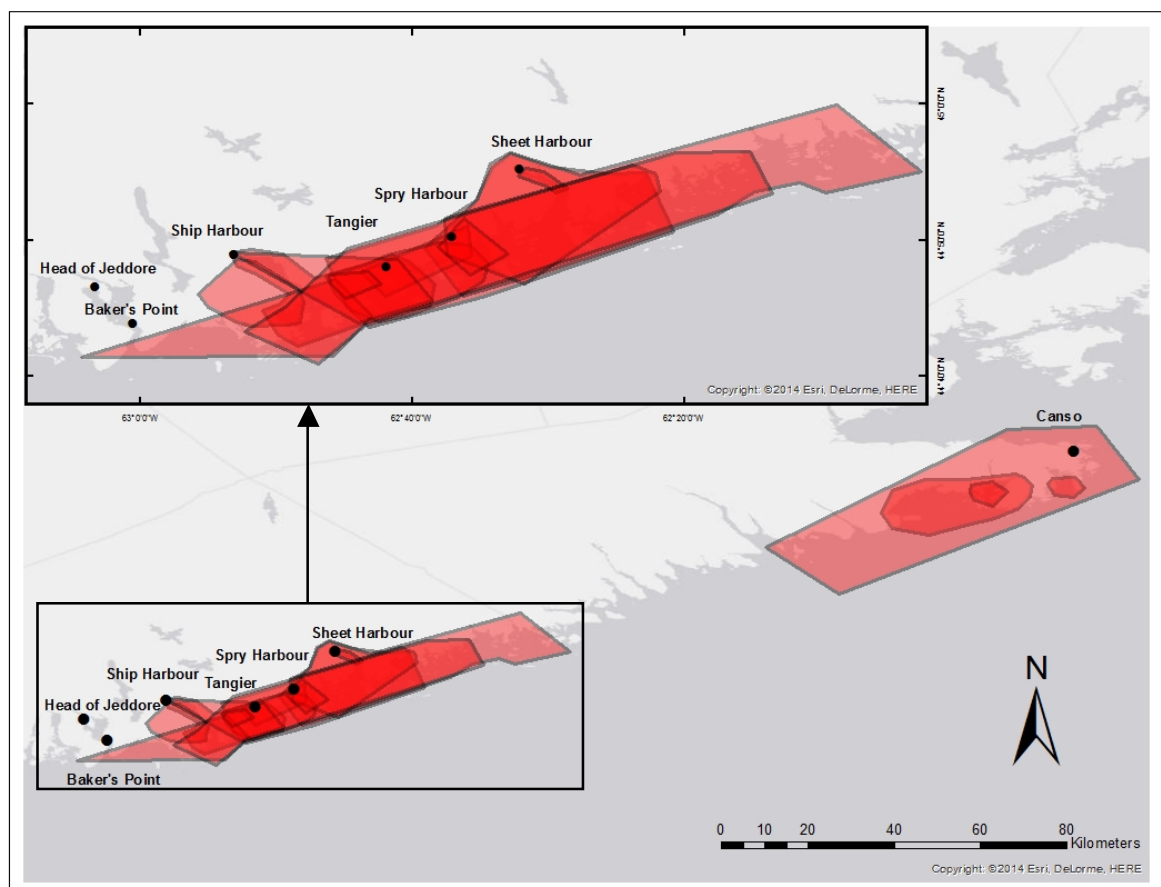


Figure XIV: Perceived geographic areas of conflict with existing and/or potentially expanding salmon aquaculture along the Eastern Shore of Nova Scotia as described by interviewees (in red). The communities represented through interviews are identified.

4.3.5 Alleviation of perceived conflict

Interviewees' suggestions for conflict alleviation included multiple points divided into four main areas of needed improvement: (1) Science and Information; (2) Corporate Relations; (3) Governance and Institutionalization; and (4) Finfish Aquaculture Practice (Figure XV). Two participants, although perceptive of conflict, did not make any suggestions towards conflict resolution.

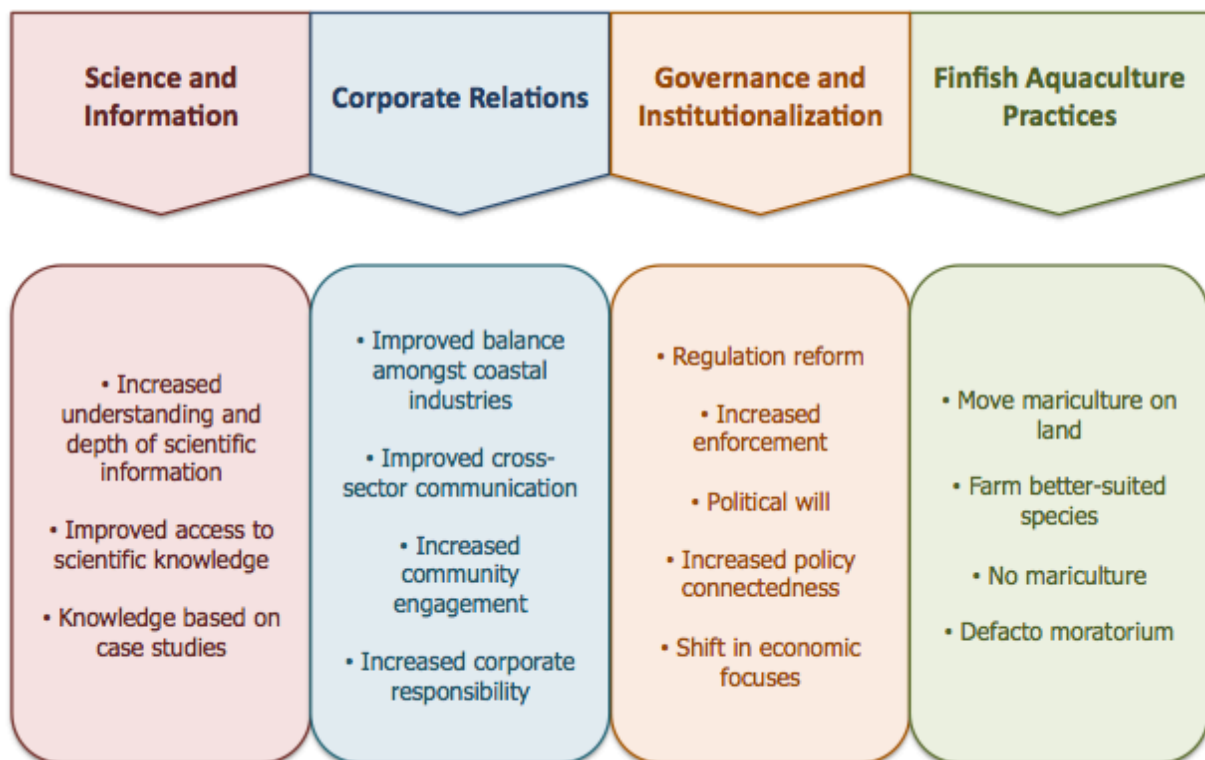


Figure XV: Suggestions for conflict alleviation and steps-forward in regards to salmon aquaculture as indicated by interviewees along the Eastern Shore of Nova Scotia.

5 Discussion and conclusions

5.1 General comparisons: media analysis, community meetings and interviews

As 50 to 60 percent of Canadians read the newspaper daily (Newspapers Canada, 2014), one can understand how influential news articles can be on the general public. That being said, when analyzing the articles and topics presented over the last year, it is clear news articles and broadcasts are most commonly speaking to the topic of salmon aquaculture. Additionally, the most common topics discussed included “Disease”, “Wild Salmon”, and “Policy and Regulation”. In correlation to such findings, within both the community meetings and the interviews, the most common topics of concern included “Negative Environmental Change”, including disease and effects on wild salmon, as well as “Governance and Institutional Issues”. These findings are also consistent with those of Walters (2007) and the Government of Newfoundland (n.d.). Those most often quoted within media pieces (academics and experts) seem to fall under “trustworthy” category as described by interviewees. That being said, business leaders within the aquaculture industry paired with all levels of government, in summation, were quoted more times than any grouping of academics or experts. These findings seem contradictory to what is expected, such that the majority of the general public receives their information through various media outlets, though – as identified through one-on-one interviews – do not trust those being quoted.

The discussions within the community meetings also broadly reflected the concerns of those interviewed, and were consistent with what was expected based on previous accounts of conflict surrounding developing salmon aquaculture in other areas in Nova Scotia, as referenced above (Bailey, Jentoft & Sinclair, 1996; Swire, 1990 and Johnson 1991 in Bailey, Jentoft & Sinclair, 1996).

5.2 Socio-economic context of results

5.2.1 Demographics and economic influences

A factor in the seeming unwillingness to accept a new industry into the Eastern Shore may be the demographics of the area. Whereas older populations occupy the Eastern Shore (Government of Nova Scotia, 2014b), the majority of the shore would expectantly be resistant to change in their industries and communities (Felix *et al.*, 2013; Krosnick & Alwin, 1989).

It is interesting to reflect on the unwillingness to accept a new coastal industry, such as aquaculture, along the Eastern Shore, paired with concerns of migrating youth to other areas of the country for work. Statistics do in fact demonstrate a high migration of Nova Scotians to western provinces, due to the pull of availability of jobs and higher wages (Figure XVI: Employment and Social Development Canada, 2013). Furthermore, these statistics do support interviewees concerns that such migration consists in majority of young people, such that the majority of migration from the province consists of those between the ages of 20 and 34 (Figure XVII: Employment and Social Development Canada, 2013). When young people, and thus families, are moving from rural areas of Nova Scotia to other areas of Canada, these areas, such as the Eastern Shore, are left with aging populations that are not only resistant to change, but also less likely to support developing industries as they have no need for work (assuming the majority of such populations are retired workers, or perhaps cottage-goers who do not require local employment).

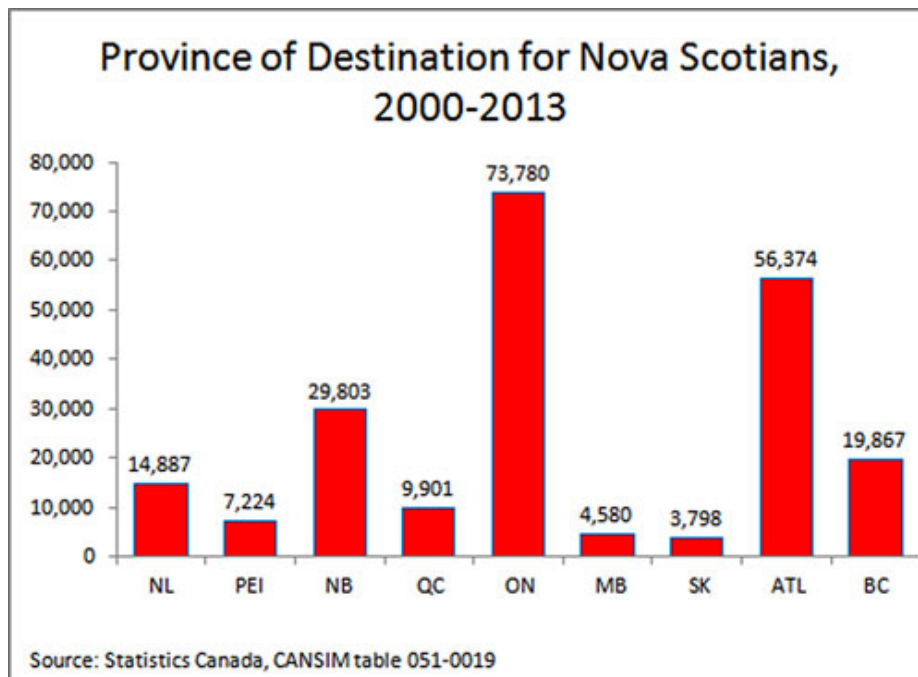


Figure XVI: Number of Nova Scotians migrating from the province, by province of destination, from 2000 to 2013 (Employment and Social Development Canada, 2013).

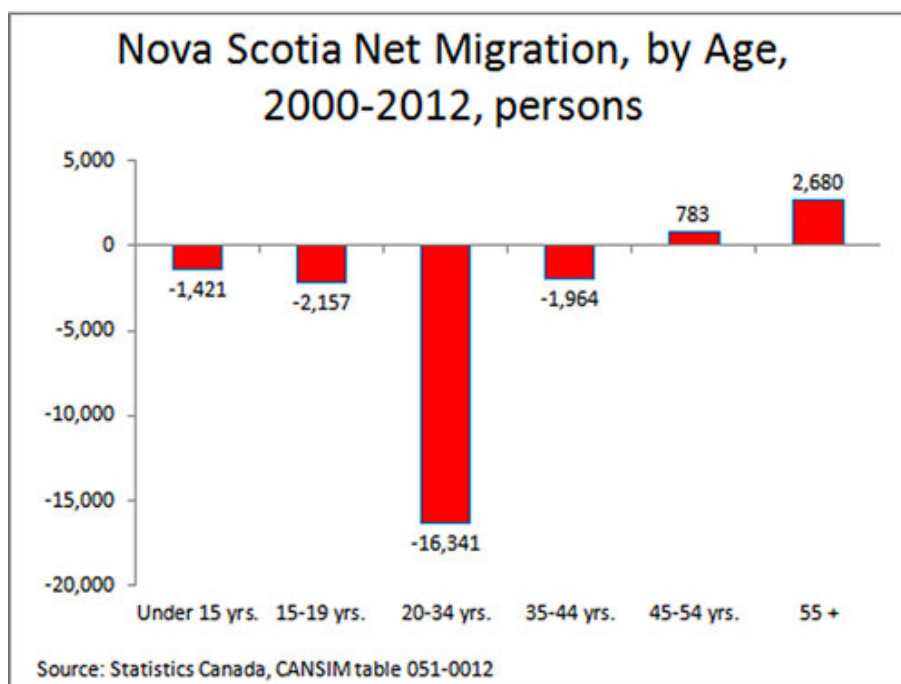


Figure XVII: Net migration of Nova Scotians by age from 2000 to 2012 (Employment and Social Development Canada, 2013).

Unemployment may also play a role in what industries may or may not be accepted into the area, whereas those interviewed from the Guysborough-Eastern Shore-Tracadie electoral district, with an unemployment rate more than double that of the Eastern Shore

district, seemed more open to collaboration among all industries to implement the new industry properly in order to keep jobs while creating new ones.

5.2.2 Social constraints

The varying comments among interviewees are contrasting to the unified front some of those with anti-salmon farming attitudes describe for the Eastern Shore (*e.g.* see APES, n.d.). Although organized groups such as The Association for the Preservation of the Eastern Shore (APES) aims to present a unified front, it seems many individuals within the community feel as though the anti-finish-aquaculture lobby is so strong that it overpowers their ability to feel safe in expressing their individual support for the finfish aquaculture industry. This lobby is strong in the message it delivers, part of which is influenced by the money through which it's supported.

Vivian Krause from Financial Post (2010) reported a money trail where multi-million dollars were – and continue to be – spent on campaigns and marketing against farmed salmon across the country, namely towards a study on sea lice conducted by Alexandra Morton, a Canadian marine biologist. Spearheading such efforts, she claims, are ENGOS such as the David Suzuki Foundation and Alaskan wild fisheries entities, such as Vital Choice and Finest At Sea Ocean Products:

The reason that Morton's U.S. funding and her undisclosed conflict of interest are such a sensitive point is because she has had a huge influence in B.C. More than 500 news stories have reported her research. In the wake of all the bad press, a “war on fish farmers” was declared and 20,000 people signed her petition to close salmon farms. The Province of British Columbia lost jurisdiction over aquaculture because of legal action that Morton initiated. Hundreds of people lost jobs when fish processing plants closed because salmon farming has been hindered. Even children have been scorned at school because one of their parents is a fish farmer.

(Krause, 2010, para. 3)

This lobby against the development of finfish aquaculture within Nova Scotia, including along the Eastern Shore, was not only expressed through specific instances of restrained

expressions of support, but a general concern of fear tactics fed by misinformation, conflict of interest relationships, and mistrust of various groups across most identified stakeholders. A persistent theme among both community meetings and interviews surrounded mistrust of government and scientists and misinformation spread to the masses. In regards to sound scientific knowledge, the current Canadian Government under Stephen Harper's direction has made access to information incredibly difficult, and in some cases, impossible; what has been often referred to as Harper's War on Science (Turner, 2013). Since his election in 2006, the flow of scientific information has been compromised through muzzling scientists themselves, to eliminating scientific programs designed to provide sound information (see Linnett, 2013 for a detailed summary of exemplary actions). Most recently, decades of research has recently been destroyed or rendered less accessible to scientists and the public after seven Fisheries and Oceans libraries closed – or are to be closed – across the country (McDiarmid, 2014). Mass media, corporations, and organizations are able to provide information to the public regarding environmental matters, including aquaculture development, but with increasing difficulty in accessing third-party and/or governmental studies, the ability to distinguish fact from biased persuasion becomes more difficult. The library closings were part of a larger budget cut, which also eliminated about 500 jobs from the DFO Coast Guard services: those who are entrusted with the duty of protecting our oceans (De Sousa, 2013). These circumstances and federal decisions certainly contribute to mistrust of the government as described by multiple interviewees.

5.3 Recommendations for the Eastern Shore and further research opportunities

5.3.1 Regulatory reform

One of the most prominent suggestions for industry improvement included regulatory reform. Though the province has enlisted a third-party panel to suggest a new framework, it is unknown how this framework will be accepted. The plan for new regulatory framework was announced May 1, 2013, by former Fisheries and aquaculture Minister, the

Honourable Sterling Beliveau (New Democratic Party). The current Fisheries and Aquaculture Minister as of October 2013 is the Honourable Keith Colwell (Liberal), and it is strongly urged that the findings from the 18-month-long review process be taken into serious consideration by the new provincial government. Though the reform is for all forms of aquaculture, there has been a strong focus on finfish aquaculture in the province. The elements of the process include community meetings, round-table discussions, targeted stakeholder meetings, a science and traditional knowledge committee, community dialogue and research, and individual contributions (see: aquaculturereview.ca/project for more information). The independent review commenced in May of 2013, as such, results and final presentation to the provincial government is expected later in 2014.

5.3.2 Risk analyses

The social perception of risk is influenced by many factors including cultural, institutional, psychological, and social predispositions (Kasperson *et al.*, 2006). Exaggeration of risk can manifest either at the transfer of information and in response mechanisms of an individual, and thus, society as a whole. Such transfers of information are facilitated through media, community meetings, and interviews. Though risk assessment may seem complex, there are tools through which to analyze social, environmental, and economic risks in order to make fact-based decisions.

5.3.2.1 Social risk analysis

Social risk analysis is an essential component of a holistic risk analysis for any developing industry, as it encompasses stakeholder perceptions and their expectations of industry, which can be a huge determinant in acquiring a social license to operate:

Social risk can often be visualized as the gap between the boundary of responsibility that these organizations acknowledge and that perceived by their stakeholders.

(FAO, 2008, p. 212)

The following (Figure XVIII: FAO, 2008) represents a framework that could be used to identify social risk in aquaculture development, whereby understanding the two-way relationship between social contexts and the project in question allows one to uncover not only social risks, but also opportunities.

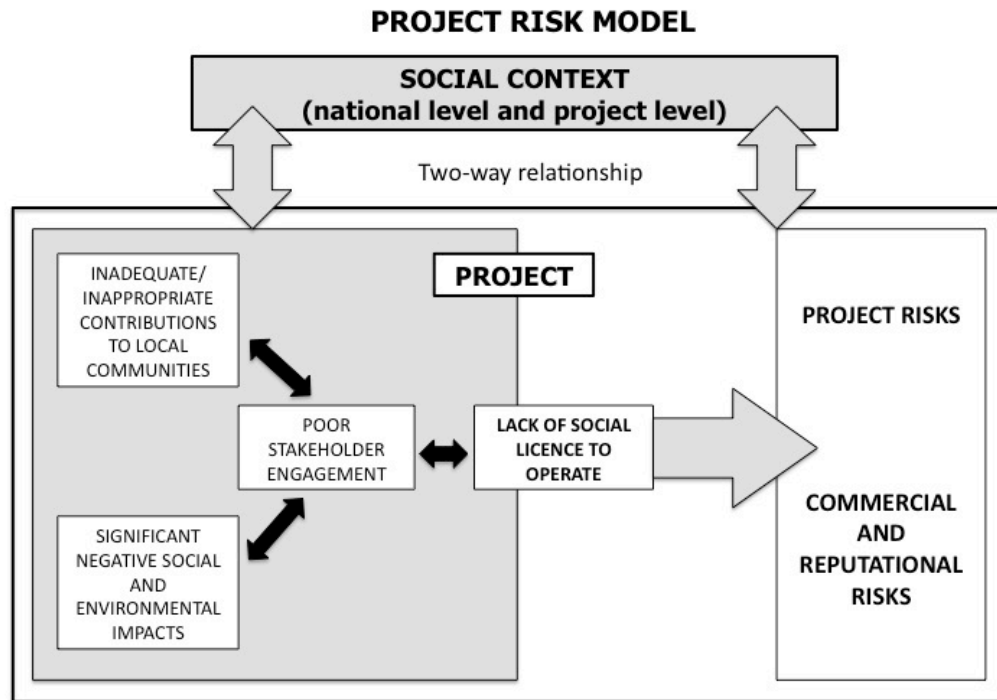


Figure XVIII: Project social risk model, as may be used for social risk analysis for salmon aquaculture sites (adapted from FAO, 2008).

This analysis is, in part, being covered by the regulatory reform process through hearing concerns of residents and workers across the province. This model is especially relevant before the details of an aquaculture project is decided upon. Early stakeholder engagement is needed in order for parties involved to feel accountability for the stewardship of shared resources (Gao & Zhang, 2006). That being said, the social risk model should be considered through all stages of industry development, not solely the planning stages of a proposed site. Meaningful stakeholder engagement is critical in order for participants to feel as though their opinions are equally valued and considered. This is only possible when stakeholders feel safe in addressing their concerns, unlike what has come to light in one-on-one stakeholder interviews along the Eastern Shore of Nova Scotia.

5.3.2.2 Environmental risk analysis

Environmental risk analysis is appropriate in designing regulation, siting and making site-specific decisions, prioritizing such risks, and comparing risks (FAO, 2008). Though environmental risk analysis is demanding in terms of resources, it is suggested that an environmental risk analysis be conducted for the Eastern Shore, and Nova Scotia as a whole, in order to determine areas of opportunity within aquaculture development based on sound decision-making. This analysis could include, for example, risk analysis of sea-based finfish aquaculture along the Eastern Shore comparative to risks found with other forms of finfish aquaculture, such as closed-containment or land-based practices.

Risk estimation is a valuable tool in assessing the potential effects of a project, such that risks are quantifiable through an equation based on previously-identified existent factors:

Risk estimation integrates the outcomes of the effects (consequences) and exposure (likelihood) assessments in order to determine the level of risk (*i.e.* consequences x likelihood) to environmental values (end-points).

(FAO, 2008, p. 110)

Once such endpoints are determined, the acceptability of an activity, such as aquaculture development, can be determined using a simple matrix (Table VIII: Standards Australia, 2004a in FAO, 2008).

Table VIII: Risk evaluation matrix for determining level of risk (Standards Australia, 2004a in FAO, 2008).

Probability of exposure	H	Yes	No	No	No	No
	M	Yes	No	No	No	No
	L	Yes	Yes	No	No	No
	VL	Yes	Yes	Yes	No	No
	EL	Yes	Yes	Yes	Yes	No
	N	Yes	Yes	Yes	Yes	Yes
		N	L	M	H	C
Significance of Consequence						

¹Yes = the risk is acceptable and the activity can be permitted; No = the risk is unacceptable and the activity cannot be permitted without further risk management.

²Level of probability: H = high, M = moderate, L = low, VL = very low, EL = extremely low, N = negligible

³Level of significance: C = catastrophic, H = high, M = moderate, L = low, N = negligible

5.3.2.3 Economic risk analysis

Collapse or threat to existing economic providers along the Eastern Shore seems to be a very real worry among those concerned with ocean-based aquaculture. Though rural areas of Nova Scotia, including the Eastern Shore, are in need of jobs, it should not be at any cost. Once it is decided that a project should be carried out based on environmental criteria, an economic analysis may shed light on how many local jobs and generated income would be gained from a developing industry, such as aquaculture. Assuming an end-point in the environmental risk analysis being “existing lobster populations maintained”, it would be assumed at this point that the existence of aquaculture would not eliminate any existing inshore lobster businesses. A Cost-Benefit Analysis (CBA) is a common method of assessing the economics of a given project (Bunting, 2013). That being said, it should not be used exclusively as a decision-making tool, as it is difficult to incorporate many social and environmental concerns into a CBA.

5.4 Research limitations and suggestions

The most challenging aspect of this project was that conflict regarding aquaculture in this particular area of the province was, and continues to be, an evolving issue. To highlight, after the decision had been made to pursue this topic, the province has announced its plans for regulatory reform within the industry. Part way through the research, potential leases were rejected, and existing sites dismantled. The ever-changing scenarios made it difficult

to acquire information, as some requests were sensitive in that they related to imminent conflict and business-related decisions. In terms of the robustness of the media analysis, it would have served useful to include more locally-based news sources, such as the Chronicle Herald. By doing so, stronger conclusions could have been made in regards to the province-specific conflict regarding finfish aquaculture. These important news sources were missed by following the search suggestions laid out by Gould, 2004, too strictly.

Additionally, the research was time-sensitive in that there were only months in which to complete the work. Time issues, paired with unexpected transportation alterations – brought on by a post-accident vehicle write-off – and weather concerns meant interviews had to either be cancelled, rescheduled, or conducted in a secondary manner to the original methodology. Suggestions for continued and/or similar work would be to complete an ethics review, even if not required by the supporting institution. By doing so, there is a clear plan to follow from methodology to expectations to the purpose of the research. This guidance is particularly useful when working on a restrictive timeline. Flexibility in schedule is also ideal, where unexpected events may require modifications to the original research plan. Reaching out and networking early on is key in attaining the requested information and in building rapport with interviewees, allowing them to share controversial opinions on current conflict in their communities. Lastly, with all the concern brought up in community meetings and interviews regarding ulterior motives and conflicts of interest through funding sources, a positive aspect of this project was the fact that there was no outside funding, and thus no reason to assume persuasive results.

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